

AUDIT QUALITY, AUDIT PRICING, AND INFORMATION ASYMMETRY:
THE IMPLICATIONS OF PEER REVIEW

By

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Historically, the accounting profession, through various oversight committees and boards, has promulgated standards to regulate the quality of the auditing function. One such regulation adopted by the AICPA was the creation of the peer review process. The purpose of the present study is to address the implications of the peer review process on audit demand, audit quality provision, and audit pricing within the auditing market.

Based on the economic incentives of market participants, hypotheses were developed to examine these implications. This study was conducted utilizing the experimental markets methodology to examine various institutional settings by manipulating the demand for audit quality and the availability and timing of the peer review process.

The results of this study demonstrate that the information provided by the peer review process is useful to buyers in assessing the quality of services they are receiving. The results indicate that the heterogeneous demand for audit quality creates a disparate valuation of the peer review process. In markets where audit quality was not important to buyers the ability to identify high quality providers by utilizing peer review was of minimal value. In markets where high quality audit services were demanded, the information provided by a 1-yr peer review process increased the quality of audits provided in the market. The 3-year review process currently utilized within the profession did not significantly alter the market results from the non-peer reviewed markets.

These results imply that the peer review process has the potential to address regulators concerns regarding the quality of the auditing but that the timeliness with which the information is received is critical. The results of this study support the ability of the peer review process to provide quality differentiating information to buyers of audit services that improves their ability to purchase high quality auditing services, if desired.

CHAPTER 1 INTRODUCTION AND BACKGROUND

Introduction

The market for audit services has received broad attention in the extant accounting literature. Initial investigations addressed concerns about the lack of sufficient competition within the auditing market as expressed by governmental and regulatory agencies (e.g., Metcalf Committee Report, U. S. Senate [1977]). In contrast, practitioners (Public Accounting Report [1992]) and accounting oversight boards (American Institute of Certified Public Accountants [1978]) have been concerned that there is too much competition present in the auditing market. Research findings (Simunic [1980], Dopuch and Simunic [1980], and Danos and Eichenseher [1986]) support the view that extensive competition exists in the market for audit services which may lead to deterioration of audit quality and a reduction of auditor independence. While the concern about auditor independence has been reduced somewhat by the findings of DeAngelo [1981a],¹ the concern about audit quality has escalated, fueled by the increasing rate of litigation from audit failures, and

¹DeAngelo [1981a] found that when future quasi-rents are available to auditing firms, if the client companies incur transaction costs to switch auditors and there are initial start-up costs for new auditors, the occurrence of low balling should not affect independence, because the low balling itself does not create the future benefits. It is just a competitive response to obtain the future benefits.

Congressional [1978] and GAO [1986] reports criticizing audit firm departures from GAAS.

One necessary, but not sufficient, condition for the establishment and maintenance of high quality audit services is the ability of audit fees to adequately compensate firms that make the required investments in personnel, audit technologies, and training to allow for the production of high quality service. Economic theory, (e.g. Akerlof [1973]), indicates that for high quality services to be compensated adequately, consumers must be able to differentiate between quality levels provided in the marketplace. However, product differentiation is a perplexing area for CPA firms because it may be difficult for clients to differentiate quality, *ex ante* or *ex post*, among competing firms. Further confounding this asymmetry is the potential presence of a heterogeneous demand for audit quality between prospective clients. These factors may create a setting which encourages high quality producers to exit the market as they may not be able to recover their costs of production.

The extant research on product differentiation has focused mainly on the examination of audit firm size as a proxy for quality by examining

- fee differentials on continuing engagements (e.g., Simunic [1980]),
- litigation experience (Palmrose [1988]),
- stock market reaction to auditor switching (e.g., Nichols and Smith [1983]),
- IPO valuation (Menon and Williams [1991]),
- auditor switching (Chow and Rice [1982]), and

- the presence and magnitude of "low-balling" for initial audit engagements (e.g., Simon and Francis [1988]).

While the general result from this research is that audit firm size serves as a quality surrogate, there are several inconsistencies present. No relationship has been found between audit firm size and an auditing firm's propensity to issue qualified opinions (Chow and Rice [1982]), the magnitude of "low-balling" on initial engagements (Simon and Francis [1988]), or auditor switching before an initial public offering (Menon and Williams [1991]). Additionally, while the extant literature on the competitive nature of the auditing market indicates that the market is competitive with a fee differential to large firms who participate in the small auditee market (Palmrose[1986] and Francis and Simon[1987]), no direct evidence has been found concerning what factors allow a firm to price their services above the competition and still obtain an engagement.

Experimental economics has also been used to investigate the audit quality issue. In this type of investigation, participants exchange experimental commodities or services at negotiated prices or values in an experimental market. Theories are developed, based on individual economic rationality, to predict the outcomes of each market's transactions. Numerous studies have utilized this research approach to examine

- auditors incentives and decisions when their quality choices cannot be directly observed (e.g., Dejong, Forsythe, Lundholm, and Uecker [1985]),
- the demand for strategic auditing, (Kachelmeier [1991]), and

- low-balling for initial engagements (Schatzberg [1990]).

Each of these studies has extended our understanding of how the individual economic incentives of participants in the auditing market influence decision making. However, extant laboratory market investigations of the auditing market have not been able to isolate sufficient market conditions which could sustain the development of high quality audit services.

Purpose of the Research

The concerns regarding audit quality have not been ignored by the accounting profession. The American Institute of Certified Public Accountants (AICPA) issued the Commission on Auditor Responsibilities: Report Conclusions and Recommendations (AICPA, 1978) which contained a specific recommendation that peer review be used to foster improvement in the performance of accounting firms. Subsequently, the AICPA established the AICPA Division for Firms to organize, conduct, and oversee the provision of peer review services. The objective of the peer review process is to ensure that accounting firms are complying with generally accepted auditing standards in their provision of auditing and accounting services. Peer review is a costly process that provides a potential monitor of audit quality to prospective purchasers of audit services and users of financial statements.

The purpose of the present study is to address the implications of the peer review process on audit demand, audit quality provision, and audit pricing within the auditing market. Based on the economic incentives of market participants, hypotheses

will be developed to examine these implications utilizing the experimental markets methodology.

Organization of Remaining Chapters

Chapter 2 will review the contributions from various methodological and theoretical paradigms which address the issues of product differentiation among auditors and incorporate a discussion of the objectives of the present research.

Chapter 3 will provide the theoretical development and statement of hypotheses to be tested. Chapter 4 will develop the research design and experimental methods.

Chapter 5 discusses the research results. A summary of the study and conclusions are presented in Chapter 6.

CHAPTER 2 REVIEW OF RELEVANT RESEARCH

Agency Theory

Agency theory investigates the contractual relationship between a principal and an agent. The principal is typically assumed to have a utility function that is increasing in agent performance and decreasing in payments made to the agent for their services. The agent is assumed to have a utility function increasing in payments received from the principal and decreasing with effort exerted. In these settings optimal outcomes can only be achieved under certain conditions. One such setting is when the agent's actions and private information are perfectly observable by the principal. Unfortunately, this setting is often unrealistic for application to "real-world" contractual negotiations. Therefore, the agency literature has expanded to include numerous solutions to the principal/agent problem which attempt to minimize the inefficiency created by information asymmetry, or agency costs, resulting from the inability of the principal to observe perfectly the agent's actions and motivations.

One such solution, originally proposed by Harris and Raviv [1979] and Holmstrom [1979], is that any costless monitor, even if imperfect, that provides some positively correlated information regarding the actions of an agent or the overall state of nature should be used by the principal to reduce the agency cost arising from information asymmetry. If a monitor does not provide useful information it's use

could potentially increase the risk of the agent and lead to welfare reducing decisions. Additionally, the authors proposed that if the monitor is costly, the benefits received from use of the monitor should exceed the cost to ensure that net societal welfare is improved.

The Role of Auditing

The role of the auditor has been theorized to be a potential monitor of the principal agent relationship between the owner/investors (equity or debt) and manager of a company. Ng [1979] posits that the value of auditing services lies in the fact that it enhances the value of the economic information generated by the accounting process. Auditing is viewed as assisting the user of financial statements in assessing the quality of those statements. Ng and Stoeckenius [1979] note that the demand for auditing arises due to the nature of the contract between managers and owners, where owners cannot directly observe the output of the firm (i.e., financial results). In this setting with asymmetric information, the owners/investors must rely on the earnings reported by management to make their investment and compensation decisions. Audits represent a costly, yet imperfect, monitor of the principal/agent relationship.

If auditing is demanded to reduce and/or monitor agency costs, do owners/investors have a homogeneous demand for auditing services?

DeAngelo[1981b] makes the argument that auditors and their respective market find each other based on the quality of audit product demanded, and supplied by the audit firm. Consequently, some clients, such as a nonpublic or public company with large

management ownership, might not require the highest quality audit.¹ Other clients, especially widely held public companies, potentially demand a higher quality audit given the increased agency cost of professional management. Therefore, distinct levels of audit quality may be demanded for different levels of agency monitoring (Wilson [1983]).

Empirical Results

If heterogeneous levels of audit quality are desired, how is audit quality to be defined and differentiated? Given that it is costly for consumers of audit services to evaluate audit quality, DeAngelo [1981b] argues that auditor size serves as an efficient surrogate for audit quality. This is because larger firms, in an attempt to portray a consistent level of quality to the market, have a reduced incentive to lower audit quality to fit a particular engagement.² Therefore, large firms should have higher overall audit quality.

Research has examined evidence of heterogeneous effects created by audit firm size differentials regarding auditor litigation (Palmrose [1988]), stock valuation (Nichols and Smith[1983] and Eichenseher, Hagigi, and Shields[1989]), IPO valuation (Menon and Williams [1991]), auditor switching (Chow and Rice [1982]), audit fee

¹In these situations the motivation for hiring the auditor might be to simply fulfill regulatory requirements, or to attain some other service or benefit from the auditor in addition to the attest function.

²An issue not addressed by this research is the potentially divergent incentives between the individual auditor and the firm. Auditors are motivated by factors such as time pressure, client acquisition requirements, fee collections, and office profitability which might create incentives to disregard firm quality control standards.

differentials (Simunic [1980], Palmrose [1986], Francis and Simon [1987], and Simon and Francis [1988]), and the incidence and magnitude of "low-balling" on initial engagements (DeAngelo [1981a], Ettredge and Greenberg [1990], Schatzberg [1990], Simon and Francis [1988], and Turpen [1990]). The quality/size proxy most often used in this research was the classification of firms as Big Eight vs. non-Big Eight.

While the general result from this research is that audit firm size serves as a quality surrogate, Simunic [1980] notes that differentiated products are not observed directly but rather are revealed by differences in prices which are associated with differences in observed product characteristics. He notes that care must be taken when assessing price differentials and other measures of audit quality given all the variables that could affect auditing quality.

Supporting Simunic's propositions, Carcello et al. [1992] isolated the following four factors, which may or may not be correlated with audit firm size, as predictors of audit quality based on questionnaires received from financial statement preparers, auditors, and users: 1) audit team and firm experience with a client, 2) industry expertise, 3) responsiveness to client needs, and 4) compliance with generally accepted auditing standards. Therefore, while firm size is the easiest proxy for auditor quality to examine given the availability of data, this proxy is not necessarily capturing all the quality differentiating information available to clients.

Simunic's prudence is confirmed by the presence of several inconsistencies in the research findings regarding the ability of audit firm size to effectively proxy for audit quality. No relationship has been found between audit firm size and an auditing

firm's propensity to issue qualified opinions (Chow and Rice [1982]), the magnitude of "low-balling" on initial engagements (Simon and Francis [1988]), or auditor switching before an initial public offering (Menon and Williams [1991]). Additionally, while the extant literature on the competitive nature of the auditing market indicates that the market is competitive with a fee differential to large firms who participate in the small auditee market (Palmrose[1986] and Francis and Simon[1987]),³ no direct evidence has been found concerning what factors allow a firm to price their services above the competition and still obtain an engagement.

Whether the inconsistent results are driven by the poor specification of the theoretical models utilized, or the inability of the quasi-experimental methods applied to adequately control for potential confounding variables, is unclear. Many factors, as mentioned earlier, could be proxied by firm size, only one of which is audit quality, which is itself not defined in a consistent manner in the extant research.

Experimental Economics

Experimental economics provides a means to directly test an economic theory while controlling for the effects of potentially confounding variables. Experimental settings give the theory its "best shot" in a controlled setting such that, if the theory fails in this setting, its ability to handle more robust situations is questionable. Theories which are supported in a laboratory market can later be examined under different methodological paradigms to determine their robustness. Several excellent

³Palmrose and Francis and Simon classified companies with assets of less than \$40MM as "small".

reviews of laboratory market research have been written (e.g., in the economics literature see Plott [1979] and Smith [1980 and 1982]).⁴ Smith [1982] characterizes an economics experiment as a market environment which consists of economic agents, or the experimental participants, the characteristics they possess, and the commodities they are endowed with. Institutional allocation rules within the experiment control the communications, trading environment, property rights and the rules of cost imputation. Experimental settings usually involve manipulating the institutional setting, within the market environment to test hypotheses regarding the equilibria sustained for commodity prices and volumes, and the affects of such decisions on the allocative efficiencies within the market.

When utilizing the experimental economics methodology, it is necessary to control both the environmental and institutional parameters to maximize the proposed theory's predictive ability. Additionally, the preferences of the experimental participants must be controlled. Experimental economics relies on the theory of induced demand (Smith [1976] and Plott [1979]) for this purpose. By using induced demand, the experimenter can create supply and demand conditions for an imaginary commodity in the laboratory by mapping commodity transactions into cash payments. Several experimental precepts must be considered and complied with for the induced

⁴Vernon Smith also produces an ongoing series entitled Research in Experimental Economics, most recently published in 1991. Smith, Schatzberg, and Waller [1987] provide a summary of the application of experimental economics to the study of auditing markets.

demand theory to be effective. Smith [1982] defines these precepts as privacy, dominance, non-satiation, and saliency.⁵

Numerous laboratory market studies have been performed in the extant literature. Of relevance to this paper are several studies which have examined the demand for audit services. In particular, a study by DeJong, Forsythe, Lundholm, and Uecker [1985], hereafter DFLU, examined the price and quality of services delivered by sellers (auditors) to buyers in market settings where the sellers were not bound by their quality representations made to buyers during the negotiation process. Sellers could agree to deliver high quality services and subsequently deliver lower quality without the buyers' knowledge. This creates a setting where the effort level of the seller is not directly observable to the buyer, or an environment with moral hazard. DFLU found that auditors were initially able to command higher prices by consistently providing services above the minimum quality level in their multiperiod markets. However, they could not isolate conditions which provided sufficient returns to prevent auditors from opportunistically reducing their quality in later periods. To further examine this relationship, they allowed buyers to purchase investigations regarding auditor quality and operationalized various legal liability environments. Neither

⁵Briefly, nonsatiation requires that subjects always prefer more to less. Saliency requires that subjects understand the link between their action choices and the reward received. Dominance is achieved by paying subjects sufficient rewards such that any potential affects of other characteristics in their utility functions are controlled. Privacy controls for subject reactions to payments made to other participants. All rewards must be private information.

modification significantly affected their results regarding the inability of auditors to earn sufficient profits to maintain the provision of high quality services.

DeJong, Forsythe, and Lundholm [1985] likewise were unable to isolate conditions to mitigate the effects of information asymmetry regarding auditor quality. They found that sellers (auditors) utilized pricing strategies to "rip-off" buyers. Sellers would price their services at high levels but provide low cost/quality services in settings where buyers could not observe seller effort. The gains to sellers from utilizing this "rip-off" strategy were greater than from the provision of consistent, high quality service.

In a later study by Brozovsky [1990], experimental subjects were allowed to purchase an asset that had a depreciating reputation value. Sellers (Auditors) who did not purchase reputations earned the greatest profits in the experiment. Sellers who purchased this reputation did command higher prices, but not at sufficient levels to recover their reputation investment. Therefore, the investment in reputation was not efficient from the seller's perspective.

While it is possible to question the assumptions and market variables applied in each of these experimental markets, the consistent finding that sellers (auditors) were not able to earn sufficient returns to encourage the maintenance of high quality services is a significant result. While the ability to make inferences to actual market environments from experimental settings is limited, this result follows the intuition and concern of "real world" audit market participants that audit quality is not sufficiently rewarded in audit prices.

Audit Quality and Peer Review

Historically, the accounting profession, through various oversight committees and boards, has promulgated standards to regulate the quality of the auditing function. However, this privilege is not guaranteed as noted by the Metcalf Committee Report from the U.S. Senate (1977), which was very critical of the accounting profession's self-regulation efforts and the quality of the attest function. The Committee was especially interested in the profession's policies established to monitor and maintain audit quality.

Partially in response to the Metcalf Committee Report, the AICPA issued the Commission on Auditor Responsibilities: Report Conclusions and Recommendations (Cohen Commission, 1978). A specific recommendation cited in the report was that peer review be used to foster improvement in the performance of accounting firms. In 1977, the AICPA established the AICPA Division for Firms to provide peer reviews. The AICPA Division for Firms contained two separate sections, the SEC Practice Section (SECPS) and the Private Companies Practice Section (PCPS). Membership in these organizations was voluntary and after joining the SECPS/PCPS firms had 12 months to undergo their first peer review. Thereafter, a peer review is performed every third year.

Briefly, a peer review involves the examination of a firm's quality control procedures, including compliance with generally accepted auditing standards such as independence, proper training, and proper supervision. A sample of the reviewed firm's audit workpapers are examined to ensure that the audits were properly planned,

performed, and reviewed and that the auditor's opinions were supported by sufficient evidential matter. Reviewed firm's can contract with the AICPA Division for Firms or a qualified member firm to conduct their peer review.

During the past fifteen years since the creation of the AICPA Division for Firms, the market for accounting services has undergone radical changes. The prohibitions on advertising and client solicitation have been lifted and competitive pressures are continually increasing. Additionally, the recent problems within the thrift, banking, and real estate industries have convinced regulators and legislators that there is a need to improve the quality of the attest function (Berton [1990]). Following the recommendations of the Metcalf Committee, the SEC recommended in 1987 that all CPA Firms involved in the audit of publicly traded companies undergo peer review. In 1989 the AICPA membership adopted such a requirement for all firms that perform audits of publicly held companies. For those firms to retain their membership in the AICPA, they must be a member of the SECPS of the AICPA Division for Firms. An effect of the AICPA and SEC actions was to increase the regulation of the auditing market by placing an additional cost on firms wanting to maintain their AICPA membership and/or their publicly traded clients.^{6,7}

⁶The SEC does not require membership in the AICPA for auditing firms engaged by public companies, so firms can continue to perform public company audits without joining the SECPS if they are not members of the AICPA.

⁷Previously, in 1987, the AICPA's members approved the requirement that all member firms of the AICPA participate in a mandatory quality review program. Quality review differs from peer review in several ways. The most notable is that quality reviews are not "public" information. This research will focus on the peer review process where the resulting reports are public information.

This requirement was not well received by AICPA members from small accounting firms. In a survey of small accounting firms, many of whom had voluntarily joined, and subsequently withdrawn from the SECPS or PCPS, Wallace [1988] found that firms' concerns centered mainly on the added cost of undergoing review, the lack of perceived benefit from the entire peer review process, and the inability of membership in the AICPA Division for Firms to increase client contacts and generate new business.⁸ These concerns appear to be justified as the AICPA has acknowledged that the cost of on-site reviews could place a disproportionate expense on firms with only a small number of audit clients (Huff and Kelly [1989]).

Peer review is a costly process which provides a potential monitor of audit quality to prospective purchasers of audit services and users of financial statements. Therefore, it is necessary to examine the benefits provided by the peer review process to ensure that the benefits of peer review exceeds its costs. The extant literature on the benefits derived from peer review is limited. One study by Francis, Andrews, and Simon[1990] looked for evidence that peer-reviewed audit firms in the AICPA Division for CPA Firms are perceived as quality-differentiated auditors as evidenced by the ability to command a fee premium. If a sufficiently large fee premium exists, then audit firms should undergo review voluntarily. If not, then regulation might be required to coerce firms into the peer review process. Using data from 1984 and

⁸While the direct cost of peer review is moderate for small firms, the indirect cost of review could be substantial. The overall cost of complying with a new set of quality control procedures, increased continuing education and liability insurance requirements, and required concurring partner review on all public company audits, could substantially increase the smaller firm's costs.

1985,⁹ for client companies with sales of less than \$125MM and audits performed by non-Big Eight auditors, the authors found no systematic fee differential between peer reviewed and non-peer reviewed firms. The authors present two interpretations of this result. The first is that peer review costs are trivial so a fee differential is not required. However, they note that the lower percentage of membership among small firms is prima facie evidence that there is an economic cost to joining the AICPA Division for Firms. Second, the auditing market is not willing to pay for a quality differentiated audit. This gives audit firms no incentive to join even if the cost is trivial. This interpretation supports the aforementioned concerns of firms regarding the cost benefit relationship of peer review.¹⁰

Deis and Giroux [1992] found peer review to be a significant explanatory variable in determining audit quality, as defined for reviews of auditor workpapers for audits of Texas Independent School Districts by the Audit Division of the Texas Education Society. Their findings are the first to show that peer reviewed firms maintain higher quality levels. However, their study did not examine the ability of peer review to increase audit fees.

⁹Note that this time period is before the AICPA mandated peer review requirement became effective.

¹⁰An alternative interpretation is that the econometric techniques utilized were not able to efficiently isolate the effects of peer review from the numerous confounding factors that are present in the auditor selection process. This interpretation motivated the selection of the experimental markets methodology for this research so that potentially confounding factors could be controlled.

How societal welfare is affected by the peer review of auditors is not directly measurable. The consumer potentially receives a higher quality product. However, an argument can also be made that many consumers of audit services do not require, or desire, a higher quality and higher cost audit. Another concern is the effect of the requirement on the participants in the audit market. The effect of peer review is unlikely to be consistent across firms. Small firms, who wish to continue their membership in the AICPA, may perceive peer review as an increase to their cost of operations which reduces their ability to compete in the auditing market. A contrasting view is that if clients find it difficult to determine an audit's quality, lower quality firms might be benefitting from the overall quality perception of the profession. Lower quality firms could also have a competitive advantage over other firms due to their lower costs of operation.

Another concern relates to the quality of attest services provided. Regardless of the characteristics of audit demand that exists in the auditing market, anecdotal evidence suggests that the current monitoring devices such as Ethics Committees and State Oversight Boards, which require suspected low quality auditors to be "turned-in" by their peers, are ineffective at maintaining quality at the prescribed standard for the profession (GAO [1986]). Therefore, while rational consumers are aware that differential quality levels are provided by auditors, the lack of differentiable quality information induces consumers of audit services to value the audit product uniformly

across suppliers.¹¹ In this setting, the profession is ripe for the entry and success of "free riders" who carry the proper certifications but do not uphold the quality standards of the profession.¹² Currently, these individuals and firms are difficult to identify due to the lack of a sufficient monitoring system. This could contravene the effectiveness of the attest function for outside parties who rely on the audited financial statements to make informed contractual decisions.

Peer review represents the accounting profession's response to regulators concerns about the quality of the attest function. The impetus behind peer review was to provide all audit clients and their related investors with an acceptable level of audit quality (Huff and Kelly [1989]). However, an important incremental benefit from peer review is that auditing firms might be able to differentiate their services based on their inclusion in the peer review process. Peer review could help eliminate "free riders" by forcing them to adhere to a set of minimum quality standards. This would reduce the provision of low quality service in the profession and therefore increase the overall quality assessment of all firms, even if firm specific reputations cannot be developed.

Product differentiation is a perplexing area for CPA firms because it is difficult for client firms to differentiate between their services and those of a competing firm. This tends to make the demand curve more elastic and increases firm's incentives to

¹¹For example companies have been shown to perceive audit quality as homogenous across firm classification as Big Eight or non-Big Eight (e.g. Simunic [1980]).

¹²This depends on the other barriers to entry that may be present. However, such barriers are likely to be lower, or less costly to achieve, for lower quality firms.

engage in price competition. This is evidenced by accounting professionals responding to a recent Public Accounting Report [PAR] FAX poll [1992] which indicated that fee-based competition is increasing. Eighty-six percent of respondents characterized fee-based competition as high or extreme. An analysis of auditor changes during 1987 in PAR [1988], revealed that fee considerations were the most often cited reason, by a 2-to-1 margin, for changing auditors. Thirty-seven (Sixteen) percent of auditor switches from Big Eight (other) firms were motivated by the ability to reduce fees.

The Present Research

The purpose of the present study is to address the implications of the peer review process on audit demand, audit quality provision, and audit pricing within the auditing market. More specifically, I will examine the influence of peer review on auditor's quality decisions and the impact of the peer review process on purchasers of audit services in assessing the quality and related value of audit services. The primary question addressed in this study is whether peer review provides information to purchasers of audit services which allows sufficient audit fees to encourage and support the provision of high quality auditing services.

Given that audit quality has been notoriously difficult to define and measure, I will define audit quality as audit firm compliance with GAAS.¹³ This is the standard monitored by the peer review process and has been identified by Carcello et al. [1992]

¹³The aforementioned litigation explosion and the GAO report [1986] on audit quality which found that 34% of governmental audits examined had serious departures from GAAS support the proposition that a significant number of audits do not comply with GAAS.

as one of the major factors potential clients consider when assessing auditor quality. This research will rely on the peer review process as a monitor of auditor quality (compliance with GAAS) which avoids many of the difficulties associated with the audit size proxy.¹⁴ Peer review is public information which indicates whether a firm is, or is not, complying with GAAS. In this setting firm size is not important. All firms who comply with GAAS can receive an unqualified peer review report.

¹⁴This definition of audit quality does not allow examination of the possibility that firms can provide audit services of a higher quality than that required to comply with GAAS. This is an area for future research.

CHAPTER 3 DEVELOPMENT OF MODELS AND HYPOTHESES

Introduction

The objective of this section is to develop a buyer-auditor model that is both compatible with the theoretical features of research interest and receptive to laboratory market operationalization. I will define the market environment, determine the buyers' and auditors' optimal behavior, and discuss the related incentives of the players within each market setting.

Model Settings and Definitions

Consider a market in which every individual (player) can be either a buyer¹ or an auditor. A buyer can employ the services of an auditor to attest to the current state of nature (S). The state of nature represents the true financial position, stated in accordance with GAAP, of the audited company.² The state of nature will be

¹The buyer will represent individuals who utilize audited financial statements in making contracting and investing decisions. This could be an investor who seeks to monitor the owner/manager, or an owner who seeks to monitor the manager. A buyer could also represent equity investors or shareholders, debt investors or creditors, and include other groups that are affected by management behavior such as employee groups.

²A possible effect that is not investigated by this research is the influence of audit quality on management effort. If management is confident that its diligent efforts will be accurately reported by the audit this might increase managers' incentives to exert more effort. This research exogenously provides probabilistic information about the state of nature to buyers and does not consider the manager's incentives regarding the accurate reporting of the true state of nature.

dichotomous taking on a low value (S_L) or a high value (S_H), respectively ($S_L, S_H \in S$).³ Information asymmetry is present in the market because buyers are not able to observe the state of nature directly. Ex ante, the buyers believe that the state of nature is S_H with probability ϕ , or $P(S=S_H)=\phi$, and conversely $P(S=S_L)=1-\phi$.⁴ Ex post, the buyers' information about the state of nature will be based on the audited financial statements. The payoff to the buyer will be determined by the report of the audited financial statements. Therefore, the buyer receives compensation based on the audited financial statements report and not the true state of nature. Note that the buyer must retain an auditor in order to receive compensation.⁵

An auditor's ability to attest to the actual state of nature is dependent upon their investment in audit quality. Each audit's quality (q) can be either high (q_H) or low (q_L), respectively ($q_H, q_L \in q$). The cost of providing q_H (q_L) quality is represented as C_H (C_L). Incurring C_L implies that in performing the audit the auditor might not perform sufficient procedures and/or does not come to the correct assessment from procedures performed.⁶ Low quality audits will have more difficulty detecting the true

³Dichotomous variables will be utilized in the formulation of the model to facilitate analytic tractability and reduce notational complexity.

⁴This proxies for buyers private information about the true state of nature.

⁵Buyers receive compensation in the experimental setting only by purchasing auditor services. This relates to the "real" world in that companies cannot be traded on a public stock exchange without audited financial statements. Additionally, audits are usually required by financial institutions who provide debt capital. Therefore, auditing is often a prerequisite to attaining debt or equity capital.

⁶This could be due to either an insufficient level of training or knowledge regarding GAAP and GAAS applications or the opportunistic reduction of audit quality provided.

state of nature and will be less likely to discover a material departure from GAAP. To provide high quality services, the auditor will be required to make additional investments in audit quality ($C_H > C_L$).⁷ Incurring C_H increases the likelihood that the true state of nature will be detected.⁸

For each contract completed between an auditor and buyer, the auditor will privately observe a probabilistic signal (α_i) on the state of nature.⁹ The following conditional probabilities capture the interaction among the auditor's report (R), the actual state of nature (S), and the audit's quality level (q_i) (α_i for $i = q_H, q_L$):

$$P(R = S \mid q = q_i) = \alpha_i$$

$$P(R \neq S \mid q = q_i) = 1 - \alpha_i$$

The auditor's ability to observe the true state of nature will be an increasing function of the audit quality (q_i) level chosen, or $\alpha_H > \alpha_L$.¹⁰

⁷These investments could consist of quality increasing measures such as continuing education training, concurring partner review, and firm adherence to a quality control plan that address numerous areas of control procedures within the firm itself.

⁸Given that audit quality is dichotomous, there will be no lag between the quality investment decision and the ability to provide the corresponding quality of service. Auditors can choose to make quality improving or reducing decisions at the beginning of each period by selecting the quality they will provide before contracting with buyers.

⁹Each buyer can purchase an audit during each period. Auditors can contract with more than one buyer.

¹⁰The audit's ability to incur each type of reporting error is symmetrical for states of nature that are high or low. While this does not capture the potential reality that this relationship is not symmetrical, the qualitative results are not affected by this assumption.

Each auditor will then issue a private report (R), that represents the audited financial statements, to their buyer indicating a high (H) state or a low (L) state, respectively ($H, L \in R$). Based on this report the buyer will receive a high (low) payoff denoted as X_H (X_L). The auditor will be required to truthfully report the state observed.¹¹

The decisions that will emerge from the aforementioned market setting will be affected by the competitive pressures in the marketplace, the players preferences including their demand for audit quality, and the beliefs of the buyers regarding the quality of the auditor's services. To consider each player's preferences it is important to remember that each player's objective is to maximize his or her own expected utility. Buyers derive utility from contracting with an auditor for reporting services. Auditors derive utility from being engaged by buyers at compensatory rates for reporting services.¹²

¹¹Note that, if the quality decision is made before contracting, adverse selection is present, if after, moral hazard is present. This model addresses the adverse selection issue by not allowing the auditor to deviate from their quality decision and requires truthful reporting of the outcome observed.

¹²Given that the state of nature and auditor quality levels are uncertain, expected utilities cannot be evaluated without a specific assumption as to the risk preferences of the market participants. Consistent with extant research, throughout this paper I will assume that the buyers and auditors are risk-neutral. If the assumption of risk neutrality does not hold, players behaviors could potentially deviate from the solutions predicted by the theoretical model due to characteristics of their personal utility functions that were not adequately controlled in the experimental setting. See DeJong, Forsythe, Lundholm, and Uecker [1985] for a detailed discussion of the risk neutrality assumption.

The Buyer's Valuation of Audit Services

The buyer's valuation of audit services requires explicit consideration of two factors. First, the impact of auditor reporting errors must be considered. To clarify, auditor reporting errors can occur under two scenarios. First, when $(R=L|S=S_H)$ the state was high but the auditor did not detect the true state which results in a payoff to the buyer of X_L instead of the appropriate payoff of X_H . Second, when $(R=H|S=S_L)$, the true state of nature was low and the payoff received should have been X_L . However, the audit attested to financial statements reporting the state as high so the buyer received X_H . When this occurs, a penalty (λ) that represents costs generated by inaccurate audited financial statements will be incurred by the buyer.¹³ This penalty is

¹³The ability of various liability regimes to affect auditor effort has been previously examined (e.g., DFLU [1985]) and will be explicitly excluded from this experiment. Therefore, the auditor's only loss from providing low quality service is the potential effects if, and when, this information becomes known. No direct penalties will be assessed to the auditor for misreporting. Note that in a utopian world the use of achieved audit risk as a measure of audit quality would be optimal. While such measures may be useful in cases in which audit risk is readily evident ex post, it may be difficult or impossible to ascertain audit risk in cases where the effect is long delayed and partial. Audit failure might not show up for several years, and there might then be doubt as to whether it was caused by the audit, by the client, or by some other circumstance. An alternative and perhaps less expensive means for averting quality deterioration may be some form of screening device by application of licensing or some form of minimum quality standard (Leland [1979]). This conforms to the information provided by the peer review process and addresses the actuality that investors incur substantial losses from audit failure. Investors potentially lose a substantial portion of their investment currently, while the auditors loss is proportional and incurred at a much later date when the litigation is finally settled.

imposed in a subsequent period when the true state of nature is revealed.¹⁴ Therefore, the market will generate an incremental cost for buyers for all periods where the auditor's report does not equal the true state of nature or ($R \neq S$).

Next, the buyer's preference for audit quality must be considered. A differential demand for audit quality may arise when an investor has an opportunity set of potential monitors of manager behavior. These include, but are not limited to, knowledge of general economic conditions, related industry performance, internal auditing and accounting reports, personal conversations with management, and the external audit. Additionally, as the investor's participation in the management of the company increases, the ability to use internal information to monitor the actions of management also increases, implying less need for, and value of, an external audit.

Since the external audit represents just one of the numerous monitors that investors can use to monitor management, the demand for accuracy is affected by the reliance placed on the audited financial statements.¹⁵ Wilson [1983] shows that in situations where investors have limited access to reliable monitors of management behavior, the demand for a more accurate audited financial statement, or more diagnostic information signal, increases. Conversely, investors who have access to other monitors that accurately indicate the true state of nature are more amenable to

¹⁴This revelation is a proxy for information that can be revealed through third party actions such as litigation, press releases of analysts, court filings, etc. Consistent with extant empirical markets research, the potential future penalties from auditor misreporting are not discounted.

¹⁵Reliance indicates to what degree investors utilize the audited financial statements in making their contracting and investing decisions.

receiving less diagnostic information from the audit. Note that in this situation the investor potentially has better information about the inherent risk present and may be willing to accept higher levels of audit risk, which is reflected in an unwillingness to pay higher audit fees. If the audit risk being provided by high quality audits is lower than desired, buyers may not be willing to pay for it. Therefore, the demand for audit accuracy can be affected by the buyer's reliance on the attest function.

This discussion suggest that a heterogenous demand for auditing services may exist. The preference for audit accuracy is affected by the degree of reliance on the audit as an indicator of the true state of nature. To incorporate the heterogenous demand for audit accuracy a weighting factor (δ) will be utilized which can be either high (δ_H) or low (δ_L), respectively [$\delta \in \delta_L, \delta_H$]. At δ_L (δ_H) this factor indicates a low (high) level of reliance on audit accuracy and will therefore reduce (increase) the influence of costs incurred by the investor from inaccurate auditor reporting.

Based on the aforementioned assumptions and variable descriptions, the remainder of this section will derive the buyer's expected valuation of audit services. It is assumed initially that audit quality is known to the buyer. Then uncertainty about audit quality will be incorporated into the analysis.

The buyer's expected value (V) from contracting for an audit of type q_i is affected by the true state of nature (S), the auditor's reporting accuracy (α), the payoff received based on the audit report (X), the level of reliance on audit accuracy (δ), and the audit fee (F_i). Using E as the expectations operator this is expressed formally as:

$$E(V | q_i) = \frac{P(S=S_H)P(R=S | q=q_i)X_H + P(S=S_H)P(R \neq S | q=q_i)X_L + P(S=S_L)P(R=S | q=q_i)X_L + P(S=S_L)P(R \neq S | q=q_i)(X_H - \delta\lambda) - F_i}{1} \quad (1)$$

Applying the notation previously described produces:

$$E(V | q_i) = \phi\alpha_i X_H + \phi(1 - \alpha_i)X_L + (1 - \phi)\alpha_i X_L + (1 - \phi)(1 - \alpha_i)(X_H - \delta\lambda) - F_i \quad (2)$$

Equation 2 indicates that when audits perfectly reveal the true state of nature (so $\alpha_i = 1$) then auditor misreporting cost are eliminated. The buyer will receive the exact compensation they were entitled to, or X_H when the true state of nature was high and X_L when the true state of nature was low.¹⁷ However, if audits are unable to perfectly report the true state of nature, or $\alpha_i < 1$, then auditor reporting errors occur. Auditors could misreport the state of nature to be low (high) when the true state of nature is high (low) which reduces buyers' expected value.

To analyze the buyers' valuation of differential audit quality, the incremental effect of audit quality (q_i) on the expected valuation from auditor services follows from equation 2 by applying substitution and simple algebra:

$$E(V | q_H) - E(V | q_L) = (\alpha_H - \alpha_L)[(2\phi - 1)(X_H - X_L) + \delta\lambda(1 - \phi)] - (F_H - F_L) \quad (3)$$

Equation (3) can be simplified by determining the relationship that holds when the buyer is indifferent regarding the provision of audit quality. When $E(V | q_H) - E(V | q_L) = 0$, equation 3 becomes:

¹⁶To facilitate the operationalization of this model into the experimental setting, the reliance factor will only be applied to the costs generated from misreporting a low state as high. Incorporation of the reliance factor to costs generated from misreporting a high state as low does not qualitatively affect the predictions of the model.

¹⁷When $\alpha_i = 1$, the second and fourth terms of equation 2 are eliminated. Therefore, when $\phi = 1$, or the state of nature is high, then $E(V | q_i) = X_H$. Likewise, when $\phi = 0$, or the state of nature is low, then $E(V | q_i) = X_L$.

$$F_H - F_L = (\alpha_H - \alpha_L)[(2\phi - 1)(X_H - X_L) + \delta\lambda(1 - \phi)] \quad (4)$$

Analysis of equation 4 indicates that the auditor's incremental ability to accurately report on the true state of nature, as measured by $(\alpha_H - \alpha_L)$, affects buyer willingness to pay higher fees. If buyers can assess audit quality, analysis of equation 4 indicates that the incremental willingness to pay for high quality audit services is increasing in α_H , λ , and δ , *ceteris paribus*.¹⁸

The interactive between the presence of auditor misreporting cost (λ) and the buyers reliance on audits (δ) indicates that both are necessary, but not sufficient, conditions for a demand for high quality auditing services to exist. This indicates that the demand for high quality auditing services is influenced by a combination of the presence of auditor misreporting cost and the reliance on the audit by the buyer in making contracting decisions. This interaction will be subsequently referred to as the buyer's reliance cost.

This analysis shows that the buyer's valuation of audit services is affected by several independent and interacting factors. However, as shown by equation 4, before

¹⁸This requires the assumption that $\alpha_H > \alpha_L$ which follows from the additional investment made in audit quality as detailed earlier. Given that the second term of equation 4 can produce a positive or negative value depending on the magnitude of ϕ , note that buyers willingness to pay the incremental fees required for the provision of high quality audits is increasing in settings where

$$\delta \lambda > \frac{(-2\phi + 1)(X_1 - X_2)}{[1 - \phi]}$$

This indicates that a buyer's desire for audit accuracy is affected by their level of reliance on auditor reporting accuracy, the relative payoffs for a high and low state, and their prior information about the true state of nature.

any of these factors have an affect on the valuation, the buyer must first be able to assess the differential audit quality present in the marketplace.

The Auditor's Valuation of Audit Services

In the market, audit quality is not perfectly determinable by buyers. With incomplete information regarding the true state of nature and information asymmetry about the audit quality level it is difficult for the buyer to assess auditor quality based on prices as auditors who provide low quality will be able to perfectly emulate the behavior of auditors who provide high quality. In this setting Shapiro [1983] shows that low quality services will be priced at cost, or $F_L = C_L$, and high quality services will be priced at

$$F_H \geq C_H + v(C_H - F_L)/\mu \quad (5)$$

Where v represents the time period for the seller to develop a reputation for providing high quality services and μ represents the time period that high quality services will be provided in subsequent periods.

As an adaption of Shapiro's model, a review process, operationalizing the peer review process, is incorporated into the model. Auditors will receive a report based on the quality of audits provided during the period(s) under review. This report (r) will indicate if the audits were of high (h) or low (l) quality ($h, l \in r$). The first review period will include the initial period after the auditor indicates they desire to enroll in the review process. Subsequent reviews will be performed on a regular interval if requested by the auditor. To receive a high peer review report all audits conducted during the period(s) under review must be of the high quality type (q_H).

Auditors can provide the peer review report information to buyers in subsequent negotiations. Only truthful revelation of the peer review report received by auditors is possible.

Since the initial peer review report is received at the end of the first period under peer review, the auditor has a potential loss from the provision of high quality services of $\eta(F_L - C_H)$,¹⁹ where η represents the number of audits provided in the initial period under review. Therefore, the fee required to recover this loss and motivate the continued provision of high quality services by auditors is:

$$\chi\sigma(F_H - C_H) + \eta(F_L - C_H) \geq 0 \quad (6)$$

or

$$F_H \geq C_H + \eta(C_H - F_L)/\chi\sigma \quad (7)$$

where χ represents the number of future periods high quality services will be provided at compensatory rates and σ represents the number of audits sold during this period.

Note that this model assumes that the time period to detect "shirking" on the peer review report is the same as the time period required for the provision of high quality audits to obtain a high peer review report. Given that the time required to establish a high quality peer review report is potentially shorter than the time period for the buyer to detect shirking, it is important to note that this pricing does not necessarily assure that the auditor's optimal strategy is to maintain the provision of high quality services. If auditors choose to lower their quality in future periods,

¹⁹This potential loss is created by the buyers incentives to accept the lowest quality offer when quality differentiating information is not available before the purchase decision.

profits could be earned until this behavior is detected by buyers. Noting this, the timing of subsequent peer reviews could affect the "honesty" of auditors since it is possible for them to provide low quality services for the periods between review without the buyer's knowledge.

If auditors adopt the strategy of initially providing high quality services to obtain a positive peer review report ($r=h$) and then providing less costly low quality services until detected by the peer review process, the profits earned are:

$$\pi\rho(F_H - C_L) + \eta(F_L - C_H) \quad (8)$$

where π represents the number of periods between reviews and ρ represents the number of audits sold each period the auditor is reducing quality. Therefore, for consistent high quality services to be provided the profits from the provision of consistent quality must at least equal the profits from opportunistically reducing quality, or comparing equations 6 and 8:

$$\chi\sigma(F_H - C_H) + \eta(C_H - F_L) \geq \pi\rho(F_H - C_L) + \eta(C_H - F_L) \quad (9)$$

It is assumed that $\sigma=\rho$, or the number of clients retained by the auditor should not be affected by the auditors strategy in the periods between review reports as the buyer's information has not been updated. If the auditor provides consistent high quality services the subsequent review report will confirm this allowing the auditor to continue to present the high (h) peer review report. If the auditor shirks and provides low quality services, buyers will become aware of this. Therefore, the number of periods a auditor can benefit from the continual production of high quality services is

greater than from opportunistically reducing quality in the periods between peer reviews, or $\chi > \pi$.

Based on these assumptions the required fee for the auditors continued provision of high quality services is determined by solving equation 9 for F_H , or

$$F_H \geq (\chi C_H - \pi C_L) / (\chi - \pi) \quad (10)$$

Analysis of equation (10) provides a significant insight. As π , or the time period between reviews increases, the auditor's fee required for the provision of high quality increases.²⁰

Analysis of Player Strategies

Single period market

As a benchmark for decision making it is useful to consider the incentives that the players would face in a single period market. Note that this precludes utilization of the peer review process as the peer review report is not available until the beginning of the second market period. With incomplete information regarding the true state of nature and information asymmetry about the audit quality level it is difficult for the buyer to assess auditor quality based on prices. Auditors who provide low quality will be able to perfectly emulate the behavior of auditors who provide high quality. As a result of the asymmetric information regarding auditor quality, the

²⁰The incremental impact of π on F_H is shown by application of the quotient rule to be

$$\frac{\partial F_H}{\partial \pi} = \frac{\chi(C_H - C_L)}{(\chi - \pi)^2} > 0$$

expected value the buyer receives from audit services is only affected by fees paid, as shown in equation 4. Therefore, the buyer's optimal response is to accept the lowest fee offered. If auditors reason that buyers will only accept the lowest fee, the auditor's best response is to provide less costly low quality services. Therefore, only low quality audits will be provided in the single period setting. The auditors expected profits will be

$$F - C_L \quad (11)$$

To determine the prices which will derive in the single period market requires a further model specification of the nature of market supply and demand for auditor services. An advantage of utilizing the laboratory markets methodology is that the structure of market supply and demand can be specified to best address the problem of research interest. This is accomplished by allocating market surplus from trade to buyers and auditors in the manner best suited to experimental hypothesis testing. The control over quantities which can be purchased (sold) can be used to generate excess demand (supply), which, at the extreme, allows the buyer or auditors to capture the entire surplus available in a laboratory market. Auditors will capture the market surplus in markets with excess demand, and buyers will capture the market surplus in markets with excess supply (Smith [1982]).

The structure of supply and demand used in this study is one of excess supply. As noted earlier, buyers can only purchase one audit but auditors can sell to as many buyers as they can contract with. This produces an excess supply of audit services. This demand and supply structure is illustrated in Figure 3-1. In an environment of

excess supply, auditors will be driven to cost based pricing. Setting equation (11) to zero determines the price for low quality auditing services of

$$F_L = C_L \quad (12)$$

Multiple period markets

The previous pricing was developed with an assumption of a single-period world. However, when there are multiple periods, as required to operationalize the peer review process, there can be numerous alternative solutions. Note that the buyer could be better off (and the seller no worse off) with an outcome involving high quality and a commensurate market price.²¹ Yet, the single period strategy for the auditor is to provide low quality auditing services. In this case, the availability of additional solutions requires a refinement of the predicted outcome. One useful and standard refinement is the notion of Pareto dominance. Here, players will tend to cooperate such that everyone receives the highest payoffs, if such cooperation is possible. A possible aid to this coordination problem is the use of the peer review signal. The accounting profession's adoption of the peer review process has the potential benefit of allowing buyers to differentiate between the quality of respective auditors. This could increase buyer willingness to pay for high quality services, in

²¹The parameters used in the experiment, as detailed in Table 1, produce the following expected values. In settings without reliance costs, buyers expected value from the purchase of high (low) quality auditing services is 426 cents (450 cents) inducing a preference for low quality. In settings with reliance costs the buyers' expected value from the purchase of high (low) quality auditing services is 372 cents (180 cents). The cost of providing high (low) quality services is 200 cents (100 cents). Therefore, in settings with reliance costs, where high quality is preferred, the buyer can capture an additional 92 cents by purchasing high quality services (372-200 + 180-100), assuming audits are priced at cost, without reducing the auditors profit.

settings where high quality is demanded, while motivating the auditor to consistently provide high quality services. If effective, peer review potentially allows a multi-period solution that is Pareto superior to the single period solution.²²

The previous discussion indicates that players optimal contracting strategies regarding the quality of auditing services are affected by the buyer's reliance costs, the availability of peer review, and the timing of peer review. The following discussion develops predictions for strategies of buyers and auditors in each market setting and provides comparative hypotheses for testing.

Markets without peer review

The analysis for markets without peer review is straightforward. Buyer willingness to pay for increased reporting accuracy is shown in equation 4 which is reproduced here:

$$F_H - F_L = (\alpha_H - \alpha_L)[(2\phi - 1)(X_H - X_L) + \delta\lambda(1 - \phi)] \quad (4)$$

As shown earlier, if buyers cannot assess the differential reporting accuracy provided by high quality services they will treat the purchase of audits as a lottery, since

²²An alternative solution is that produced by backward induction which allows the extension of the single-period solution to multiperiod environments with a known endpoint (e.g., Selten [1978]). Milgrom and Roberts [1982] show two factors that can discourage backward induction. First, information asymmetry must be present within the market setting, or players cannot have complete information about others players current decisions and motivations. Second, the setting must include repeated interactions with some possibility of players observing either the other player's past behaviors or the outcomes from other players past behaviors. Information asymmetry gives the players reason to forecast future actions based on past behaviors which can motivate players attempts to develop reputations for honoring contractual relationships (Kreps et al. [1982]). Therefore, while a single-period solution can be obtained in a multi-period setting, alternative solutions can exist.

$\alpha_H = \alpha_L$ (or $\alpha_H - \alpha_L = 0$) by implication, irrespective of their reliance on auditor reporting accuracy ($\delta\lambda$). In this setting, the buyer's incremental willingness to pay for higher quality auditing services reduces to

$$F_H - F_L = 0 \quad (13)$$

If auditors reason that buyers will only accept the lowest fee, the auditor's best response is to provide less costly, low quality services. Therefore, only low quality audits will be provided in markets without peer review irrespective of the buyer's reliance on auditor reporting accuracy. As previously shown, competition will drive prices for low quality audit services to C_L .

Markets with peer review, no reliance

In markets with peer review, buyers willingness to pay for audit quality must be addressed. In markets where buyer's have no reliance costs, or $\delta\lambda = 0$, equation 4 reduces to

$$F_H - F_L = (\alpha_H - \alpha_L)[(2\phi - 1)(X_H - X_L)] \quad (14)$$

In this setting buyer's do not rely on auditor reporting accuracy. Analysis of equation 14 indicates that increased auditor reporting accuracy, or $\alpha_H > \alpha_L$, has a differential impact on the buyer's willingness to pay increased fees based on the buyer's ex ante information about the state of nature(ϕ). To establish experimental settings where buyers would not prefer higher levels of audit accuracy, in the absence of reliance costs, ϕ was set equal to .4. In this setting buyers' will not alter their decisions based on the peer review information. Buyers' incremental willingness to pay for auditor reporting accuracy becomes $F_H = F_L$.

Auditors willingness to provide more accurate reporting services is reflected in equation 10 which is repeated here:

$$F_H \geq (\chi C_H - \pi C_L)/(\chi - \pi) \quad (10)$$

Based on the previous assumption that $\chi > \pi$ and additional assumption that $\chi, \pi > 0$, the minimum valuation of the right hand side of equation 10 is C_H .²³ Given that $C_H > C_L$ by definition, F_H must be greater than F_L for the auditor to provide high quality services. However, the buyer's valuation of audit quality is $F_H = F_L$. This lack of congruence in the valuation of audit services, in markets with peer review where buyer's have no reliance costs, will lead to auditor provision of less costly, low quality services with prices driven to $F_L = C_L$ by competition.

Markets with peer review and buyer reliance

In settings with peer review, where buyers rely on auditor reporting accuracy, the relationship for the provision of high quality services can be shown by equating the price at which buyers and auditors are willing to purchase/provide high quality services. From equations 10 and 4 this relationship can be written as

$$(\chi C_H - \pi C_L)/(\chi - \pi) = (\alpha_H - \alpha_L)[(2\phi - 1)(X_H - X_L) + \delta\lambda(1 - \phi)] + F_L \quad (15)$$

In this setting the availability of peer review may provide sufficient information to buyers to allow their valuation of high quality audit services, as represented by the right hand side of equation (15), to equal or exceed the auditors required fee for high quality services which may motivate them to provide high quality audit services.

²³Equation 10 reduces to $F_H = C_H$ when $\chi = 1$ and $\pi = 0$.

This analysis indicates that the availability of peer review will only influence the quality/price combination of audit services in settings where buyers rely on auditor reporting accuracy. Additionally, the timing of the peer review process influences the relationship shown in equation 15. Earlier, it was shown that as the periods between peer reviews increase, or π gets larger, the required price for the auditor to provide high quality services increases. Therefore, the buyer's valuation of reporting accuracy must also increase to maintain the relationship. Therefore, the interactive effect of the availability of peer review and the buyers' demand for reporting accuracy could be affected by the timing of the peer review process.

Hypotheses

The previous discussion indicates that players optimal strategies regarding the quality of auditing services to contract for are affected by the buyer's reliance costs ($\delta\lambda$), the availability of peer review, and the timing of peer review (π). Specific hypotheses will be presented to examine the quality, and respective pricing, of audit services provided in each market. Additional hypotheses will deal with the market's economic efficiency. Economic efficiency is a measure often considered in experimental markets and details the amount of resources generated by trade. This will be examined by measuring the total surplus generated in each setting, referred to as market efficiency. Market efficiency is optimized in each setting as decisions near the model's price predictions. Additionally, the allocation of the generated surplus between the buyers and auditors, referred to as allocative efficiency, will be examined. As noted earlier the structure of supply and demand within the markets indicates that

the buyers will capture the surplus generated by the market as the auditors are forced to cost-based pricing by excess competition. As the price paid for audit services nears the model's prediction, allocative efficiency will increase.

From the previous analysis the following predictions are made.

- H₁ The proportion of high quality audit services provided will be increasing in the buyers level of reliance (δ) only in markets where peer review is present and this interaction will be more likely as peer review timing (π) decreases.
- H₂ The prices of the audit services provided will be increasing in the buyers level of reliance (δ) only in markets where peer review is present and this interaction will be more likely as peer review timing (π) decreases.
- H₃ Allocative efficiency will be increasing in the buyers level of reliance (δ) only in markets where peer review is present and this relationship will be more likely as peer review timing (π) decreases.
- H₄ Market efficiency will be increasing in the buyers level of reliance (δ) only in markets where peer review is present and this relationship will be more likely as peer review timing (π) decreases.

A final hypothesis will examine the influence of peer review timing and reliance costs on auditor decisions regarding the consistent provision of high quality auditing services in markets with peer review. Remember that an auditor, after receiving a high peer review report based on past audit quality provision, can subsequently elect to provide low quality audit services without detection until the next peer review. Given that auditors incur no penalty for this strategy, other than a potential loss of future business, they will not be concerned with the buyer's level of reliance. Additionally, the model indicates that the time period between peer reviews and the required price for the continued provision of high quality services are

positively correlated. Therefore, peer review timing may affect an auditor's willingness to provide consistent high quality. This leads to the following prediction:

- H₅ The proportion of auditors "shirking" by providing low quality audits in the market periods between peer reviews, will decrease as peer review timing becomes more frequent.

Dependent variables

Information was captured on the following dependent variables to test the proposed hypotheses:

- H₁ Audit quality: the number of high quality audits purchased as a ratio of the total audits purchased for each market period.
- H₂ Market price: the mean of the prices paid for audits for each market period.
- H₃ Allocative efficiency: the difference between the market surplus captured by the buyers and sellers in each market. In markets with optimal decision making the buyer should capture the surplus so allocative efficiency is increasing in buyers surplus.
- H₄ Market efficiency: the total surplus generated in each market setting.
- H₅ Auditor shirking: the percentage of low quality audits provided when the auditor was indicating their quality to be high with a high peer review report.

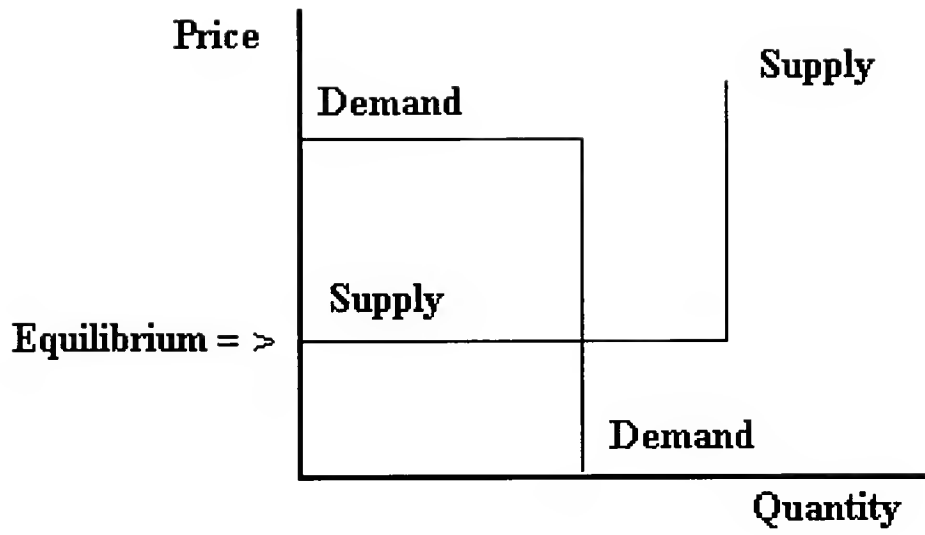


Figure 3-1: Forced Excess Supply

CHAPTER 4 RESEARCH DESIGN AND EXPERIMENTAL METHODS

Introduction

The present chapter will convert the conceptual model detailed previously into a series of laboratory market experiments (see Table 4-1). As these markets are created it will be important to ensure that the internal validity of the experiment is not compromised. Internal validity first requires the development of a successful laboratory market. This requires adherence to the theory of induced value (Smith [1976] and Plott [1979]), while controlling for the precepts documented by Smith [1982]. To comply with these precepts, actual monetary payoffs will be used to ensure dominance and nonsatiation. The experimental parameters were set such that experiment participants could expect to earn \$25 for their participation. Privacy was maintained by paying each subject in cash privately after the experimental session had ended. Subjects were instructed on several occasions verbally, and in writing, to not discuss the experimental session with anyone until the date given that all experimental sessions would be complete. Responses to the post-experimental questionnaire indicate that internal validity was sustained (see appendix B).

Next, it is important to control for demand effects and subject interaction in the experimental setting. The goal is to ensure that other aspects of the subjects' utility functions, such as fatigue, level of interest, and stress, do not materially change

during the experiment. This was accomplished by limiting the experiment to a reasonable period of time, approximately 2 1/2 hours, and controlling for experimental demand created by instructions, definitions, conversations, and feedback. Additionally, subjects were randomly assigned to the player types to control for possible subject variation.

The experimental instructions used generic terms such as buyers and sellers as opposed to auditors and clients to control for priors. Additionally, no mention was made that this experiment represented the auditing market. The output of the audit process was converted to experimental commodities with nondescriptive definitions. The goal was to control for potentially confounding effects from real world institutions. It was stressed that this experiment was not an examination of classroom knowledge, and that only the information provided in the experiment should be used to make decisions.

Laboratory Markets

In the experimental market detailed below, the presence or absence of peer review was contrasted with the presence or absence of reliance costs for buyers of audit services. Twelve markets were conducted with a total of four in the no reliance cost setting, and eight in the reliance cost setting to allow for an examination of two separate peer review institutions.¹ This includes a three year review that

¹The use of 4 markets in the no reliance cost setting (or $\delta\lambda=0$) was driven by the models prediction that peer review would not impact market results in this setting.

operationalizes the existing structure in the profession and a one year review that provides information regarding the effects of a more timely review process (Figure 4-1).

This research adopted an information structure similar to Kachelmeier [1991] and represents a compromise of an assumption of game theory, namely that all players have perfect information about other players' valuation, cost, and utility functions, and the precepts of induced value that require all such information to remain private in the experimental setting. For this research, the composition of payoffs was publicly communicated to all players in the laboratory market instructions. However, these instructions stopped short of communicating actual valuation and cost amounts. Buyers were informed that auditors (described as sellers in the experimental setting) incurred one of two possible investigation costs where the higher (lower) cost investigation had a 90 percent (50 percent) chance of determining the true state of nature. Similarly, auditors were informed that buyers received greater compensation for high reports and in reliance cost settings, that buyers could incur additional costs from auditor misreporting. By publicly revealing relative payoff and cost information, while maintaining the privacy of specific values, an environment advantageous to game theoretic strategies is maintained while avoiding the potential confounding effects of violating the experimental precepts.²

²Kachelmeier and Shehata [1992] found that when cost and redemption values were public information that these experimental markets were significantly less competitive than private information markets.

The reliance cost settings were operationalized with an ex post charge to buyers at the end of the game for all periods when the auditors report revealed a high state of nature when the actual state of nature was low. To improve the information environment of Kachelmeier [1991], where buyers had no information regarding the total amount of additional charges incurred until the end of the game, this experiment provided the buyers with the expected value they were earning based on the quality of audits they might have received (high or low). Therefore, the buyers could see the expected impact of a auditors provision of high and low quality audits as the game progressed while not allowing buyers to directly infer an auditor's quality during the execution of the game.

Subjects

A total of 144 subjects for the laboratory markets were obtained from student groups, mainly graduate students from the College of Business Administration. Each subject participated in one the 12 markets (eight subjects to each market).³ Subjects were informed they were volunteering to participate in an experimental session lasting approximately three and one-half hours. While it would be preferable to use "real" owners, business managers and auditors, the constraints imposed due to the monetary and time considerations render this infeasible. Additionally, Plott [1982] notes that as

³Twelve subjects were enlisted for each experimental setting to ensure that the required eight subjects were present. If more than eight subjects arrived, eight subjects were randomly selected from the subjects present and the remaining subjects were paid a small fee and dismissed.

long as real people pursue real incentives in a laboratory market, the choice of subjects should not be critical.

Procedure

After arriving at the experimental location each player received the same set of written instructions. An instructional period was then completed where the game instructions were read aloud to players and a pre-experimental questionnaire was completed and discussed to ensure the market structure was understood. After random assignment to computer workstations,⁴ which determined player classification as a buyer or auditor, a training phase (no cash earned) was then conducted that consisted of three experimental market periods that used the same computerized trading mechanism as the experimental phase. The purpose of this training phase was to allow the subjects to learn about the computer mechanism, not the behavior of others. For this reason, the experimenter gave the subjects the values to enter. Subjects were informed that these values were to illustrate the options available to them and were not to be considered as recommended behavior.

After the training phase was completed, the experimental market periods were conducted. Each market consisted of two sub-markets where players first participated in a non-peer reviewed market for 15 periods and then a peer reviewed market⁵ for the

⁴Physical barriers were present in the computer laboratory to prevent participants from making visual contact with other players. Participants were instructed that verbal contact was prohibited and this was monitored by the administrator.

⁵In the experimental setting the peer review report was referred to as an "analysis" report.

remaining periods of the game (the average length of this second market was 15 periods). No information about the second market was given before the conclusion of the first. The parameter values used are given in Table 4-2. The values were set to induce an indifference towards audit quality in the no reliance cost settings and to give the buyer a preference for high quality audits in the reliance cost settings. The sequence of decisions is detailed in Figure 4-2 and Figure 4-3 for the non-peer reviewed and peer reviewed markets, respectively.

Before each peer reviewed market began, an identical set of additional instructions was read aloud by the experiment administrator while all participants reviewed their own copy of the instructions which detailed the peer review process. Each participant was polled privately by the administrator to ensure their understanding of the additional information before the market was restarted. At the conclusion of this market, participants were asked to complete a post-experimental questionnaire. They were paid their cash earnings (privately) for all trading periods, which ranged from \$7 to \$42. Analysis of the post-experimental questionnaire responses indicated that participants understood the instructions and how their decisions would affect their earnings as indicated in appendix B.

In order to mitigate end game effects, players were informed at the end of period 27 that at the end of each subsequent period, the computer would roll a "die" with values 1 through 6. If the roll was a six, the game would end, otherwise the

game would continue on to the next period. This information was displayed on each player's computer at the end of each affected period.⁶

The markets utilized a posted offer institution. Auditors submitted offers that were visible to all buyers.⁷ Buyers chose a specific auditor. Note that this institutional setting encourages the prices to converge from "above", or prices will decline towards the cost of production in the competitive markets, since initially the auditors have the informational advantage (Smith [1982]). Given that auditor profits will be driven to zero by competition, auditors were compensated through endowments for each market period. Buyers received an initial endowment of sufficient funds to ensure they did not incur a net loss in the initial period(s) when they were likely to pay too much for audit services. Endowments also allowed the payment structure to be manipulated so that all experimental participants had the potential to receive the same expected compensation.

⁶Thus there was a one-sixth chance of the market ending on any day after day 27. This essentially produced a maximum discount factor of 20 percent ($p/(1-p)$) for the subjects. This creates an expected number of experimental days of 33 per market. Therefore, without the players knowledge, the computer always rolled a six at the end of the 33rd "day" if the game reached that point.

⁷As is common practice in experimental markets settings, to speed the convergence to cost based prices, successful offers were displayed to all players at the end of each period. Auditors did not directly observe other auditor's offers, but they were aware of the level at which contracts were being exchanged.

Table 4-1
Operationalization of Conceptual Model to Laboratory

Investor/Manager model	Laboratory Markets
State of nature can be high or low	State of nature has a high or low value
Auditors sell their audit services to buyers.	Sellers sell investigations about state to Buyers.
Buyer compensation (X_1, X_2) is contingent on the auditor's report, ($R = H, L$) with $X_1 > X_2$.	Buyers compensation from the experimenter is based on whether the state's value is reported as high or low. Payment will be greater for the high valued state.
Auditors pay the cost of providing a high or low quality audit. The quality provided is positively correlated with the ability to detect the true state of nature.	Sellers pay either a high or low cost to investigate and report on the state. The ability to detect the value of the state is positively correlated with this cost.
A probabilistic signal regarding the true state of nature is publicly reported for specific buyers, who have engaged auditors. A penalty is assessed for all periods where ($R=H S=S_L$).	At the end of applicable markets buyers must pay the experimenter a penalty for all periods in which the investigation report was high, but the true state was low.
Auditors can undergo peer review which will evaluate their audit quality level. Peer review reports are issued at the end of the review period.	Seller's can undergo an investigation of their production process. A report will be issued after the initial year, and every year (third year) thereafter, indicating the investigations rendered were high or low
A high/low peer review report will be given if the cost of the audit produced is high/low for the period under review.	A high report can only be given if the costs of the investigations produced are high for the entire period under review. Otherwise a low report will be issued. Buyer players will be instructed that a high/low report indicates that the investigations produced were high/low.

Table 4-2
Glossary of Variables

Variable	Description	Value ¹
$C_H, C_L \in c$	Auditor's cost level, high/low	200 or 100
$F_H, F_L \in F$	Fee paid for high and low quality services	
$q_H, q_L \in q$	Audit's quality level, high or low	
$h, l \in r$	Peer review report on audit quality	
$H, L \in R$	Auditor's report	
$S_H, S_L \in S$	Probabilistic state of nature with values of high (ϕ) or low ($1-\phi$)	.40 or .60
$X_H, X_L \in X$	Compensation paid by experimenter to buyer based on auditor's report ($H, L \in R$).	300 or 600
$\alpha_H, \alpha_L \in \alpha_i$	The probability the auditor is able to detect the true state of nature given his/her quality level	.90 or .50
λ	Misreporting costs incurred by buyer when ($R=H S=S_L$)	900
$\delta_L, \delta_H \in \delta$	The probability that a buyer relies on the audit as a monitor of the investor/manager relationship	0% or 100%
$\delta\lambda$	Reliance costs	0 or 900

¹Values utilized in this experiment were framed in "cents". Variables for which no value or probability is listed were determined in the negotiations between market participants.

Table 4-2 (continued)
Glossary of Variables

Variable	Description	Value
V	Buyers expected value from contracting for auditor services	
η	number of buyers engaged in initial period auditor is in the peer review process	
χ	number of periods high quality services will be provided after initial engagement	
σ	number of buyers engaged during χ period.	
ρ	number of buyers engaged in periods the auditor is opportunistically reducing quality.	
π	number of periods between peer reviews	1 or 3

	3- Year Peer Review*		1 - Year Peer Review	
	Not Available**	Available	Not Available	Available
No Reliance costs***	A ₁	A ₂	B ₁	B ₂
Reliance costs	C ₁	C ₂	D ₁	D ₂

*The three year and one year peer reviews denotes the review timing manipulation.

**Unavailable and available denotes the presence of peer review or the peer review manipulation. Cells A₁ - D₁ represent first 15 market periods and cells A₂ - D₂ represents market periods 16 +.

***No reliance costs and reliance costs denotes the reliance manipulation. There were 2 replications of cells A and B, and 4 replications of cells C and D for a total of 12 markets.

Figure 4-1
Experimental Settings

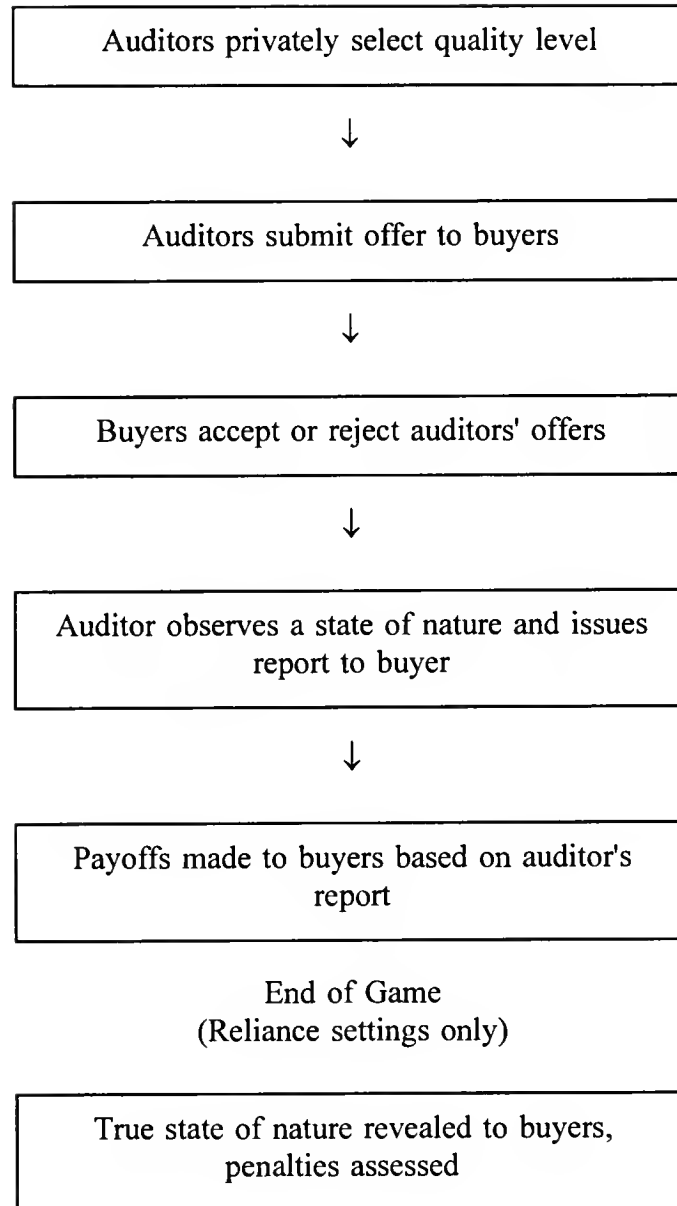
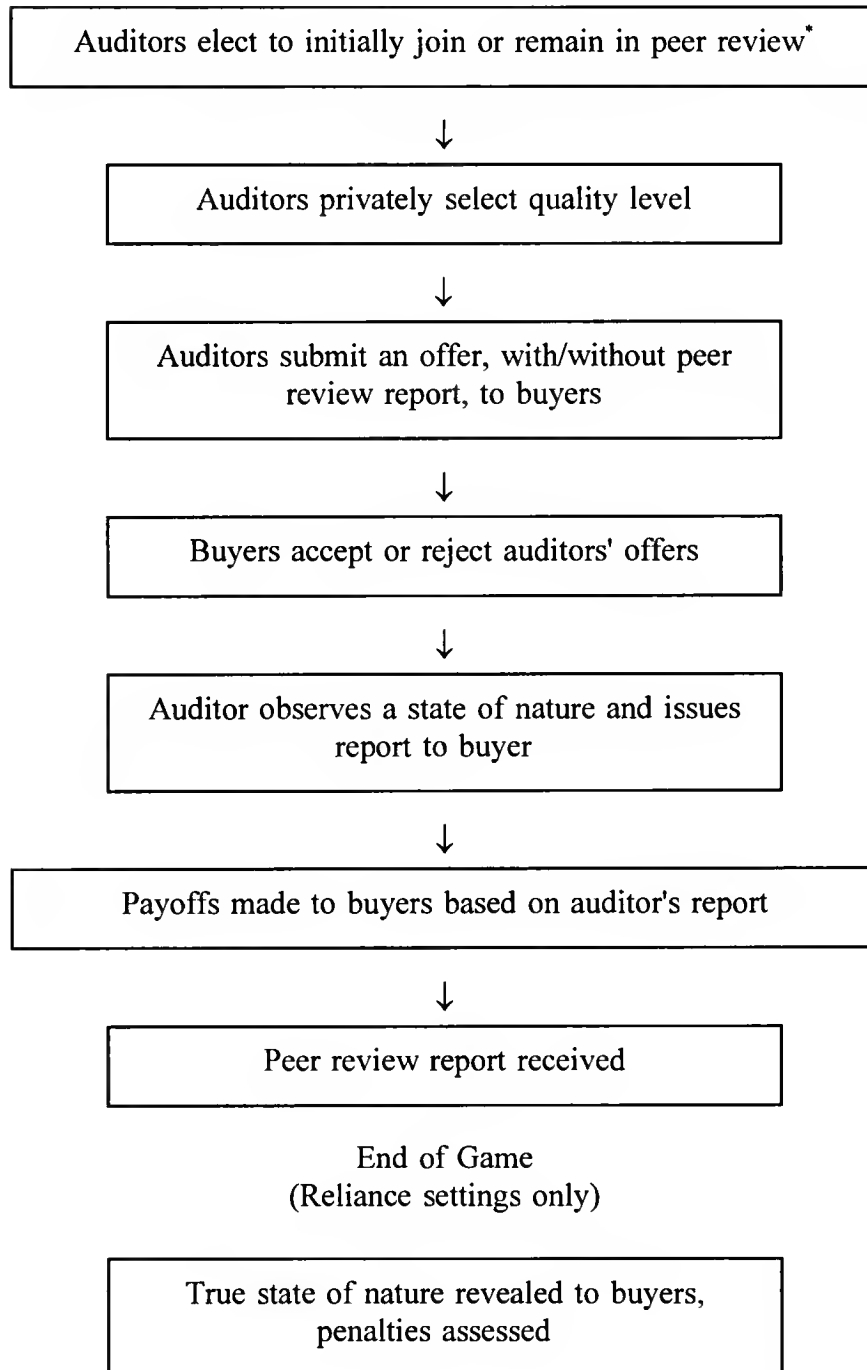


Figure 4-2
Non-peer Reviewed Settings



*After initially joining peer review, the decision to remain under review occurs in subsequent periods based on the term of the review process examined, one or three periods.

Figure 4-3
Peer Reviewed Settings

CHAPTER 5 RESEARCH RESULTS

Introduction

The no reliance/non-peer reviewed settings (A_1 and B_1) were used to provide a benchmark for determination of the interactive effects for the factors of reliance, peer review, and peer review timing. The purpose of this study is to compare the effects of these factors on player's behaviors, not necessarily to test whether a particular solution holds in a selected experimental cell. Thus, the hypotheses will be analyzed as comparisons across markets rather than as test of point predictions.¹

The markets were designed to examine market rather than individual participants behavior. Therefore, the variables tested represent the average responses for each market.

Hypotheses 1-4 were analyzed by examining each of the respective dependent variables using a repeated-measures analysis on peer review (not available, available), reliance costs (no reliance, reliance), and peer review timing (3 year, 1 year), where peer review is a within-markets factor and reliance costs and peer review timing are between markets factors. Hypothesis 5 was analyzed using a between markets design

¹Potential learning effects are mitigated by only using the last 8 periods for each market in the data analysis. Other cutoff periods produced results that are qualitatively the same. Previous experimental research has found that experience effects are mainly present during the initial stages of a market as indicated by a more rapid convergence to predicted values (i.e., Schatzberg and Sevcik [1993]).

with the factors of reliance and peer review timing, and the respective interaction term, for markets where peer review was available (markets A₂, B₂, C₂, D₂). The results are organized by dependent variable and will incorporate a discussion of the specific hypotheses affected.²

Results

Audit Quality

The results for audit quality are reported in Figure 5-1 and Panel A of Table 5-1. In support of H₁, the audit quality provided was significantly affected by the interaction of the availability of peer review (PR), the timing of peer review (PRT), and the presence of reliance costs (R) ($F_{(1,8)}=5.62$, $p=.0226$).³ To isolate the significant effects producing this interaction the analysis was extended by examining the simple interaction of reliance and peer review for the 3-year and 1-year peer review markets, respectively. The 3-year peer review markets, as shown in Panel B of Table 5-1, did not reveal a significant simple interaction ($F_{(1,4)} = .01$, $p=.471$).⁴ The simple main effects of peer review ($F_{(1,4)}=.29$, $p=.310$) and reliance ($F_{(1,4)}=1.82$, $p=.125$) were also

²The following analysis adopts the "analysis of simple effects" approach to analyzing three-way interactions as documented by Keppel [1991, p.445-452]. Briefly this analysis begins by looking at the three-way interaction and proceeds to the appropriate analysis of simple interaction effects and/or main interaction effects.

³The p-values indicated in the results section are for a directional (one-tailed) test of significance.

⁴As recommended by Keppel [1991] p. 448, when heterogeneity of within-groups variance was present in the simple interaction analyses, separate error terms based on the within-group mean squares were calculated for each of the interaction effects at different levels of peer review timing.

insignificant. This indicates that audit quality was not significantly affected by the availability of a 3-year peer review in markets with or without reliance cost.

In the 1-year peer reviewed markets, the simple reliance (R) x peer review (PR) interaction (Table 5-1, Panel C) was significant ($F_{(1,4)}=6.59$, $p=.031$).

Examination of the simple-simple effect of peer review in 1-year markets with reliance costs produced a significant increase in audit quality. The percentage of high quality audits provided was 7.81% (62.50%) in markets without (with) peer review ($F_{(1,3)}=13.66$, $p=.017$). The availability of peer review did not produce a significant increase in audit quality in markets without reliance costs. The percentage of high quality audits provided was 15.63% (12.50%) in the markets without (with) peer review ($F_{(1,1)}=.25$, $p=.352$).

These results provide strong support for H_1 . The proportion of high quality audit services provided was increasing in the buyers level of reliance in markets where peer review was present and this interaction was only significant in markets with the 1-year peer review. In markets where buyers demanded high quality services, the 1-year peer review process allowed buyers to isolate high quality auditors which increased the provision of audit quality within those markets.

Market prices

The results for market prices are reported in Figure 5-2 and Panel A of Table 5-2. H_2 is not supported in that market prices were not significantly affected by the interaction of the availability of peer review (PR), the timing of peer review (PRT), and the presence of reliance costs (R) ($F_{(1,8)}=.30$, $p=.299$). Additional analysis of

market price behavior isolated the following significant effects. First, the the main effect of reliance was significant ($F_{(1,8)}=4.40$, $p=.035$). Market prices were uniformly higher in markets with reliance costs over markets with no reliance costs. This indicates that the presence of reliance lead to higher prices irrespective of the presence or timing of peer review. Review of the market cell means (Table 5-2) indicates that buyers were potentially mislead by auditor pricing strategies in the reliance settings. Prices increased from an average of 128.67 $[(128.95 + 128.39)/2]$ in markets with no reliance costs to 167.61 $[(177.30+157.92)/2]$ in markets with reliance costs in settings without peer review. This provides empirical evidence to support Chan and Leland [1982]. They developed a theory which shows that in settings where prices are costless to observe but quality is costly to observe that sellers are able to extract surplus from uninformed buyers surplus by reducing quality rather than prices. In this study, market prices were not significantly affected by the interactive effects of reliance and peer review due to the buyers' willingness to pay high prices in settings where audit quality was not determinable.⁵

Second, the interaction between peer review and peer review timing produced significant results ($F_{(1,8)}=3.36$, $p=.050$). Analysis of the simple main effect of peer review timing produced significant results for the markets with the 3-year peer review ($F_{(1,5)}=5.11$, $p=.0367$) indicating a reduction in average prices in markets with peer review. When combined with the earlier result that quality did not increase in markets with the 3-year peer review, this indicates that the 3-year peer review did provide

⁵See Appendix C where players strategies are presented.

sufficient information for buyers to determine that low quality audits were being provided which led to reduced prices. Average prices did increase, although not significantly ($F_{(1,5)}=1.39$, $p=.145$) in markets where the 1-year peer review was present for the markets with reliance costs. These results indicate that peer review provides quality discriminating information to buyers that allows them to make more informed purchase decisions. Irrespective of the quality provided, prices moved toward the cost of providing the quality purchased, high or low respectively.

Allocative efficiency

The results for allocative efficiency are reported in Figure 5-3 and Panel A of Table 5-3. In support of H_3 , the allocative efficiency attained was significantly affected by the interaction of the availability of peer review (PR), the timing of peer review (PRT), and the presence of reliance costs (R) ($F_{(1,8)}=5.34$, $p=.025$). To isolate the significant effects producing this interaction the analysis was extended by examining the simple interaction of reliance and peer review for the 3-year and 1-year peer review markets, respectively. The 3-year peer review markets, as shown in Panel B of Table 5-3, did not reveal a significant simple interaction ($F_{(1,4)} = .01$, $p=.472$). This indicates that the buyers' ability to capture market surplus was not significantly affected by the availability of a 3-year peer review in markets with or without reliance cost.

In the 1-year peer reviewed markets, the simple reliance (R) x peer review (PR) interaction (Table 5-3, Panel C) was significant ($F_{(1,4)}=7.70$, $p=.025$). Examination of the simple-simple effect of peer review in 1-year markets with reliance

costs produced a significant increase in the buyers' ability to capture market surplus. The buyers' profits less auditors' profits were -12.98 (126.84) in markets without (with) peer review ($F_{(1,3)}=9.29$, $p=.028$). The availability of peer review did not produce a significant increase in the buyers' ability to capture market surplus in markets without reliance costs. The buyers' profits less auditors' profits were 351.03 (294.22) in the markets without (with) peer review ($F_{(1,1)}=5.22$, $p=.132$).

These results provide strong support for H_3 . Allocative efficiency was increasing in the buyers level of reliance in markets where peer review was present and this interaction was only significant in markets with the 1-year peer review. In markets where buyers demanded high quality services, the 1-year peer review process allowed buyers to isolate high quality auditors which increased their capture of the available market surplus within those markets.

Market efficiency

The results for market efficiency are reported in Figure 5-4 and Panel A of Table 5-4. In support of H_4 , the market efficiency attained was significantly affected by the interaction of the availability of peer review (PR), the timing of peer review (PRT), and the presence of reliance costs (R) ($F_{(1,8)}=2.27$, $p=.085$). To isolate the significant effects producing this interaction the analysis was extended to examination of the simple interaction of reliance and peer review for the 3-year and 1-year peer review markets. The 3-year peer review markets, as shown in Panel B of Table 5-4, did not reveal a significant simple interaction ($F_{(1,4)} = .00$, $p=1.0$). This indicates that the markets' ability to generate surplus for allocation to buyers and auditors was not

significantly affected by the availability of a 3-year peer review in markets with or without reliance cost.

In the 1-year peer reviewed markets, the simple reliance (R) x peer review (PR) interaction (Table 5-4, Panel C) was marginally significant ($F_{(1,4)}=4.06$, $p=.057$). Examination of the simple-simple effect of peer review in 1-year markets with reliance costs produced a marginally significant increase in the markets' ability to generate surplus. The total market surplus was 86.20 (158.59) in markets without (with) peer review ($F_{(1,3)}=3.09$, $p=.088$). The availability of peer review produced a marginally significant decrease in total market surplus in markets without reliance costs. The total market surplus was 376.56 (323.44) in the markets without (with) peer review ($F_{(1,1)}=18.07$, $p=.074$).

These results provide support for H_4 . Market efficiency was increasing in the buyers level of reliance in markets where peer review was present and this interaction was only significant in markets with the 1-year peer review. In markets where buyers demanded high quality services, the 1-year peer review process allowed markets to increase their generation of available market surplus. Combining this results with the results provided for allocative efficiency, the 1-year peer review allowed a pareto dominant outcome to be achieved.

Auditor behavior

To examine auditor behavior, the percentage of low quality services provided by auditors when they were presenting high (h) peer review reports, or the percentage of auditors shirking, was used as the dependent variable (Table 5-5). Hypothesis 5

predicts a main effect of peer review timing. To improve the robustness of this test an ANOVA model using reliance costs, peer review timing, and the interaction term was utilized. The interactive effect of peer review timing and reliance ($F_{(1,8)}=.03$, $p=.437$) and the main effect of reliance ($F_{(1,8)}=1.85$, $p=.106$) were insignificant. The main effect of peer review timing indicates a significant increase in shirking from 28.36%⁶ for the 1-year peer review to 64.56% for the 3-year peer review ($F_{(1,8)}=4.29$, $p=.036$) supporting H_5 .

To examine this issue more closely, the required fees for the provision of high quality services were calculated from equation (10) using the 3-year and 1-year peer review paradigms.⁷ The required fee for the provision of high quality services was 260 and 214 cents for the 3-year and 1-year markets, respectively. The average prices charged for high quality services was 232.38 and 217.71 for the 3-year and 1-year markets, respectively.⁸ Analysis indicates that the 1-year market prices were not significantly different from the fee required to maintain high quality, or 217.71 vs. 214

⁶The main effects for the 1-year (3-year) peer review were calculated as $28.36\% = (41.67\% + 15.05\%) / 2$ ($64.56\% = (75.00\% + 54.11\%) / 2$) from the cell means presented in Table 5-5.

⁷These calculations were made using 8 for the value of π , or the number of periods the auditors might expect the game to continue. Auditors using a greater (lessor) number of periods would have experienced lower (higher) valuations. The average prices paid of 217.71 (232.38) for the 1-year (3-year) markets were sufficient to support the consistent provision of high quality audit services if the auditors expected at least five or more (11 or more) future periods in the market.

⁸This was calculated by taking the accepted prices for each market for audits of high quality. Prices below 200, or the cost of providing high quality audits that represented low-balling, were not included as this test examines the ability of prices to sustain high quality services after the initial engagement.

($t_{(29)}=1.331$, $p=.1938$). However, the 3-year market prices were significantly below the required high quality fee, or 232.28 vs. 260 ($t_{(14)}=-8.719$, $p < 0.0001$). This inability of markets that utilized the 3-year peer review to sustain high quality prices could have affected the provision of high quality services and potentially motivated the "shirking" behavior isolated. This suggests that auditor behavior regarding honest representation of quality is affected by the timing of the peer review process and the buyer's willingness to pay the requisite prices to reward "honest" performance.

Additional analysis

The extant research utilizing experimental markets in settings examining quality provision (i.e., Dejong, Forsythe, and Lundholm [1985], and Brozovsky [1990]) has shown that sellers (or auditors) who choose to provide low quality services earn a greater profit than those choosing the provision of high quality desired by buyers. For this study, this was examined by determining the profits for auditors who provided high and low quality services, respectively. This analysis is restricted to markets where peer review was available, or where the ability to distinguish quality was present.

Utilizing the difference in profits between high and low quality providers as the dependent variable, an ANOVA analysis was conducted (see Table 5-6) using reliance costs, peer review timing, and the interaction term. The interaction ($F_{(1,7)}=.68$, $p=.217$) and main effects of peer review timing ($F_{(1,9)}=1.12$, $p=.162$) and reliance ($F_{(1,9)}=.05$, $p=.413$) were clearly not significant. Examination of the profit differences by cell indicates that, in reliance markets that utilized the 1-year peer review, auditors

providing high quality services earned greater profits, although not significantly so. These results indicate that auditors who chose to provide high quality services were able to earn similar profits to auditors providing low quality services. This created an environment where auditors were willing to provide the quality level desired by the buyer, contrary to the results derived in prior studies.

Summary

These results presented here indicate that audit quality provision (H_1), allocative efficiency (H_3), and market efficiency (H_4) were increasing in the buyers level of reliance in markets where peer review was present but this interaction was only significant in markets with the 1-year peer review. In markets where buyers demanded high quality services, the 1-year peer review process achieved a pareto superior solution by allowing markets to increase their generation of available market surplus while increasing the allocation of that surplus to buyers through the provision of increased audit quality in support of H_1 , H_3 , and H_4 .

The examination of market prices (H_2) did not reveal a significant interactive effect of reliance, peer review, and peer review timing. Market prices were affected by the presence of reliance costs, irrespective of the presence or timing of peer review. Buyers were mislead by auditors pricing strategies and paid excessive prices for low quality audit services in settings where peer review was not available.

Finally, an examination of auditor willingness to honestly represent their intended quality level (H_5) found that the more timely 1-year peer review produced significantly lower levels of auditor shirking in support of the hypothesis.

Chapter 6 will review the results presented here in relation to the model offered previously. Interpretations of the results, limitations, and potential for future research will also be discussed.

Table 5-1
Audit Quality

Panel A: ANOVA Results All Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Peer review timing (PRT)	1	.10188	2.37	.0813
Reliance (R)	1	.21584	5.01	.0278
PRT*R	1	.00050	.01	.4581
Between error term	8	.34460		
Peer review (PR)	1	.10842	5.32	.0250
PR*PRT	1	.07082	3.48	.0496
PR*R	1	.10842	5.32	.0250
PR*PRT*R	1	.11444	5.62	.0226 ^a
Within error term	8	.16296		

Cell Means^b

	3 - Year Peer Review		1 -Year Peer Review	
	Not Available	Available	Not Available	Available
No Reliance	0.00%	3.13%	15.63%	12.50%
Reliance	19.53%	21.88%	7.81%	62.50%

Peer Review Timing = Timing of peer review, 1 or 3 periods
 Reliance = Preference for high quality
 Peer Review = Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

^bThe cell means represent the percentage of audits provided that were high quality (low (high) quality = 0 (1)) in each market setting.

Table 5-1 (continued)
Audit Quality

Panel B: ANOVA Results 3 - Year Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Reliance (R)	1	.09770	1.82	.125
Between error term	4	.21521		
Peer Review (PR)	1	.00199	0.29	.310
R x PR	1	.00004	0.01	.471 ^a
Within error term	4	.02771		

Panel C: ANOVA Results 1 - Year Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Reliance (R)	1	.11865	3.67	.064
Between error term	4	.12939		
Peer Review (PR)	1	.17725	5.24	.042
R x PR	1	.22282	6.59	.031 ^a
Within error term	4	.13525		

Reliance = Preference for high quality
 Peer Review = Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

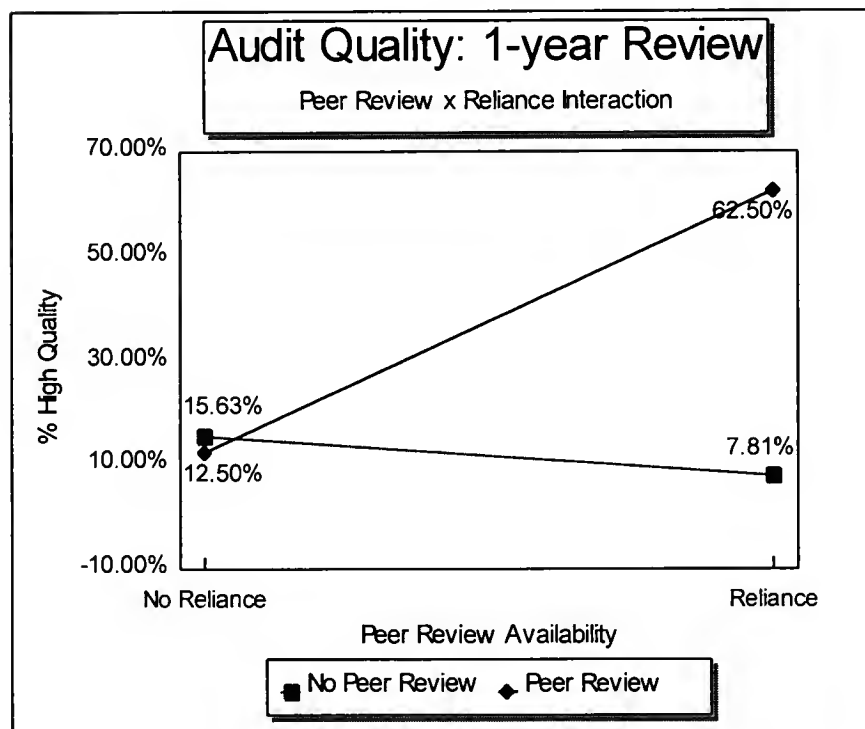
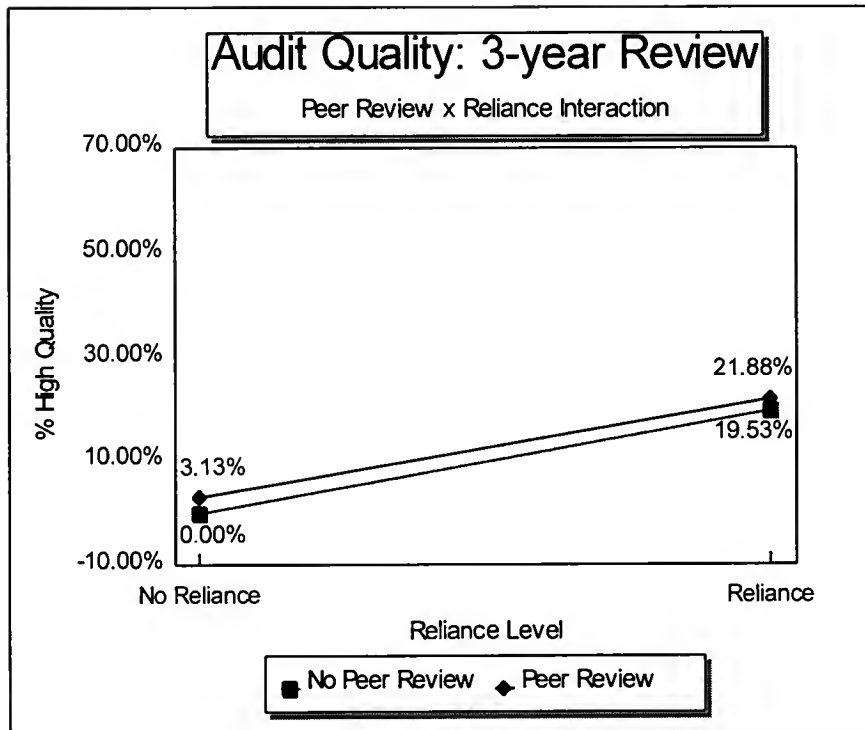


Figure 5-1
Audit Quality

Table 5-2
Market Prices

Panel A: ANOVA Results All Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Peer review timing (PRT)	1	158.35	.06	.404
Reliance (R)	1	10956.50	4.40	.035
PRT*R	1	129.44	.05	.463
Between error term	8	19940.86		
Peer review (PR)	1	195.31	.55	.240
PR*PRT	1	1304.15	3.66	.050
PR*R	1	217.50	.61	.229
PR*PRT*R	1	107.10	.30	.299 ^a
Within error term	8	.16296		

Cell Means^b

	3 - Year Peer Review		1 -Year Peer Review	
	Not Available	Available	Not Available	Available
No Reliance	128.95	105.36	128.39	127.11
Reliance	177.30	157.52	157.92	178.38

Peer Review Timing = Timing of peer review, 1 or 3 periods
 Reliance = Preference for high quality
 Peer Review = Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

^bThe cell means represent average market prices paid for audit services for each market setting.

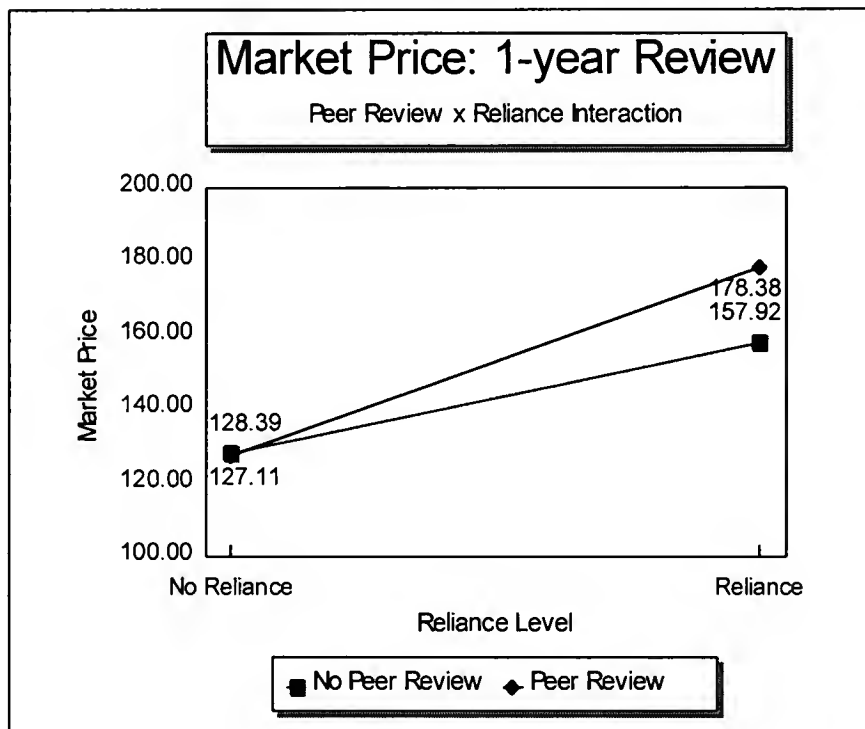


Figure 5-2
Market Prices

Table 5-3
Allocative Efficiency

Panel A: ANOVA Results All Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Peer review timing (PRT)	1	4269.35	.62	.227
Reliance (R)	1	472442.48	68.31	.001
PRT*R	1	5439.58	.79	.200
Between error term	8	55328.26		
Peer review (PR)	1	12135.81	4.92	.029
PR*PRT	1	204.79	.08	.390
PR*R	1	12601.31	5.11	.027
PR*PRT*R	1	13178.92	5.34	.025 ^a
Within error term	8	19742.83		

Cell Means^b

	3 - Year Peer Review		1 -Year Peer Review	
	Not Available	Available	Not Available	Available
No Reliance	301.47	356.47	351.03	294.22
Reliance	-26.99	25.80	-12.98	126.84

Peer Review Timing = Timing of peer review, 1 or 3 periods
 Reliance = Preference for high quality
 Peer Review = Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

^bCell means represent the average difference in surplus captured by buyers and auditors for each market setting. The expected optimal surplus available for no reliance (reliance) markets was 350 (172). If buyer's make the decisions predicted by the theoretical model, the difference (buyers surplus - auditor surplus) will approach these values.

Table 5-3 (continued)
Allocative Efficiency

Panel B: ANOVA Results 3 - Year Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Reliance (R)	1	289635.09	53.54	.001
Between error term	4	21637.28		
Peer Review (PR)	1	7746.78	4.88	.046
R x PR	1	3.24	0.01	.472 ^a
Within error term	4	6353.43		

Panel C: ANOVA Results 1 - Year Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Reliance (R)	1	188246.97	22.35	.005
Between error term	4	33690.98		
Peer Review (PR)	1	4593.82	1.37	.153
R x PR	1	25776.99	7.70	.025 ^a
Within error term	4	13389.40		

Reliance = Preference for high quality
 Peer Review = Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

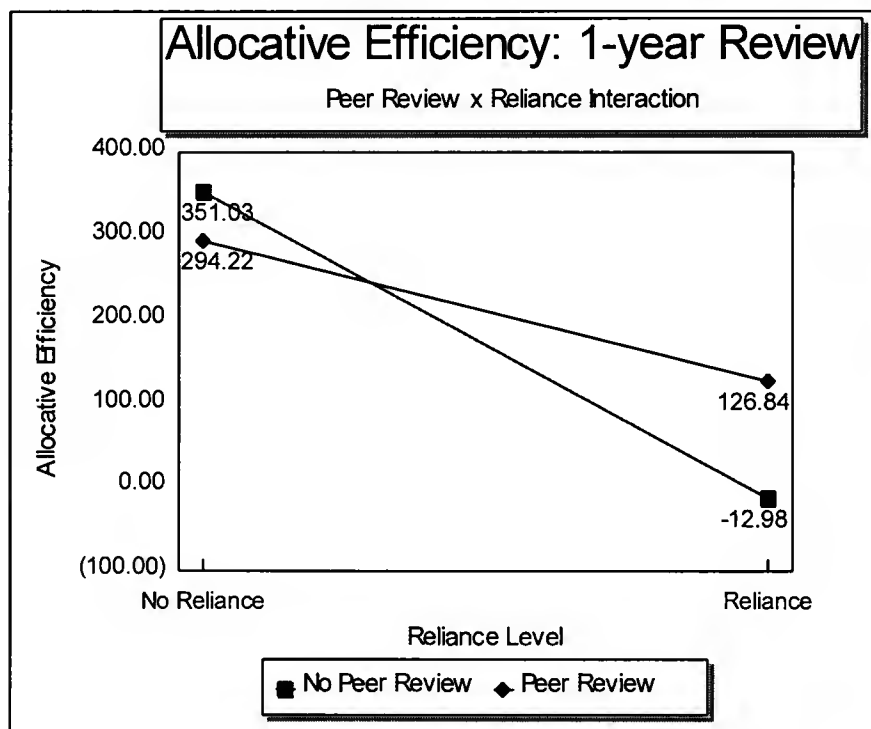
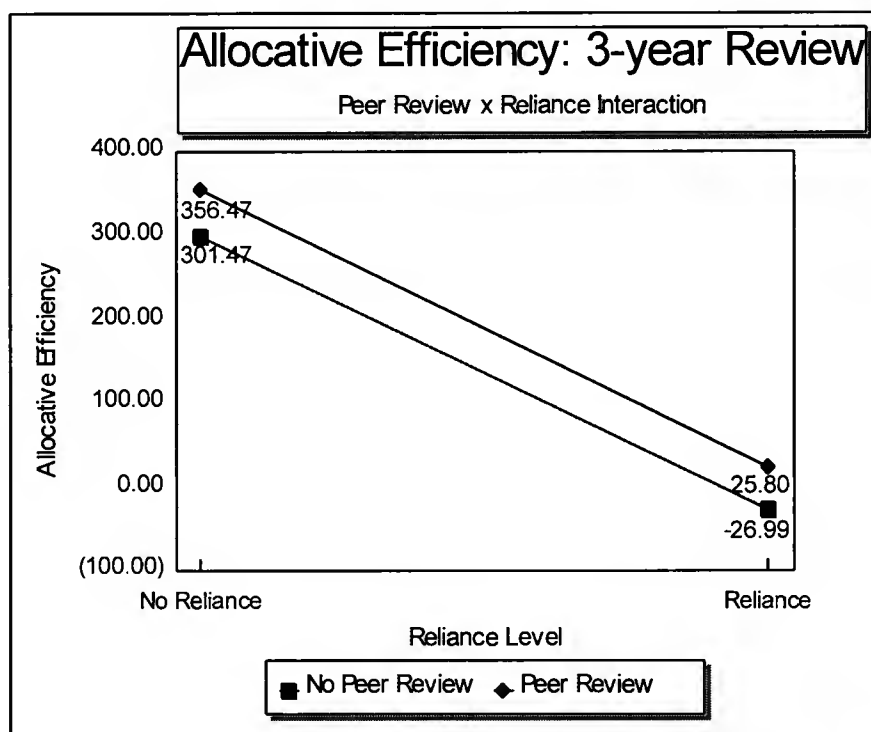


Figure 5-3
Allocative Efficiency

Table 5-4
Market Efficiency

Panel A: ANOVA Results All Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Peer review timing (PRT)	1	1056.19	.44	.262
Reliance (R)	1	333472.24	139.90	.001
PRT*R	1	2687.51	1.13	.160 ^a
Between error term	8	19068.78		
Peer review (PR)	1	134.73	.06	.409
PR*PRT	1	1397.28	.58	.234
PR*R	1	5061.81	2.21	.092
PR*PRT*R	1	5445.35	2.27	.085
Within error term	8	19183.47		

Cell Means^b

	3 - Year Peer Review		1 -Year Peer Review	
	Not Available	Available	Not Available	Available
No Reliance	359.38	360.94	376.56	323.44
Reliance	88.02	87.29	86.20	158.59

Peer Review Timing=Timing of peer review, 1 or 3 periods

Reliance=Preference for high quality

Peer Review=Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

^bCell means represent the average total surplus (buyer surplus + auditor surplus) generated by each market setting. The expected optimal surplus for no reliance (reliance) markets was 350 (172). Values may exceed the expected optimum due to randomness in the markets.

Table 5-4 (continued)
Market Efficiency

Panel B: ANOVA Results 3 - Year Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Reliance (R)	1	198016.67	44.93	.001 ^a
Between error term	4	17627.81		
Peer Review (PR)	1	.46	.00	
R x PR	1	3.50	.00	
Within error term	4	8844.39		

Panel C: ANOVA Results 1 - Year Markets				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Reliance (R)	1	138143.08	383.47	.001
Between error term	4	1440.97		
Peer Review (PR)	1	247.58	.10	.386
R x PR	1	10503.65	4.06	.057 ^a
Within error term	4	10339.08		

Reliance = Preference for high quality
 Peer Review = Peer review availability, yes or no.

^aThe p-values indicated are for a directional (one-tailed) test of significance.

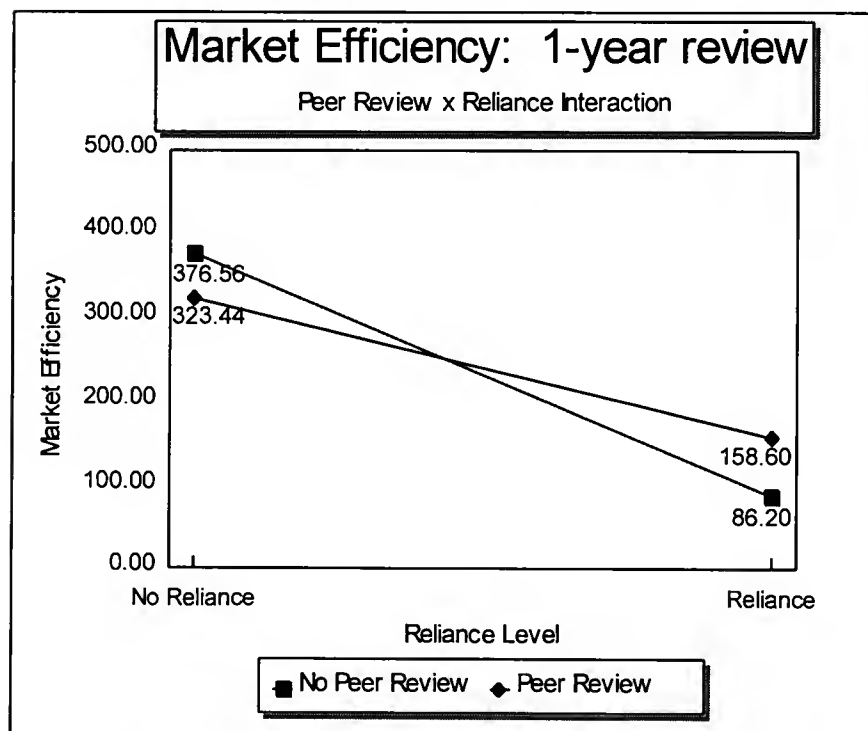
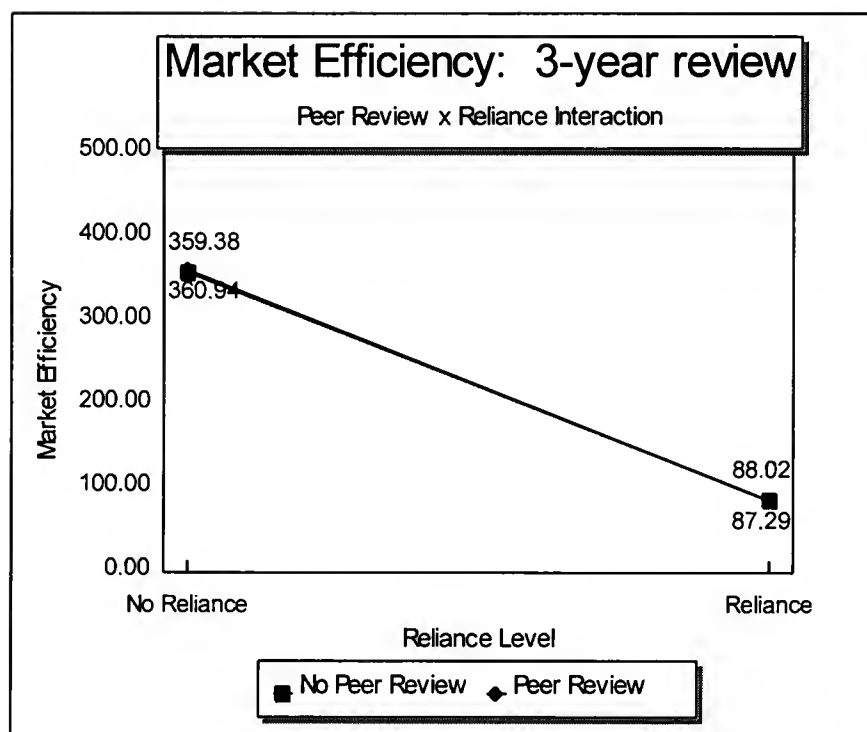


Figure 5-4
Market Efficiency

Table 5-5
Auditor Behavior

Panel A: ANOVA Results Markets with peer review only				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Peer review timing (PRT)	1	.34931	4.29	.036
Reliance (R)	1	.15045	1.85	.106
PRT*R	1	.00218	.03	.437 ^a
Error term	8	.65125		

Cell means^b

	3 - Year Peer Review	1 -Year Peer Review
No Reliance	75.00%	41.67%
Reliance	54.11%	15.05%

Peer Review Timing = Timing of peer review, 1 or 3 periods
 Reliance = Preference for high quality

^aThe p-values indicated are for a directional (one-tailed) test of significance.

^bCell means represent percentage of auditors shirking, or providing low quality investigations when providing a "high" peer review report.

Table 5-6
Seller Surplus Analysis

Panel A: ANOVA Results Markets with peer review only				
<u>Sources</u>	<u>DF</u>	<u>SS</u>	<u>F</u>	<u>Pr > F</u>
Peer review timing (PRT)	1	849.24	1.12	.162 ^a
Reliance (R)	1	39.95	.05	.413
PRT*R	1	512.19	.68	.217
Error term	7	5287.22		

Cell means^b

	3 - Year Peer Review	1 -Year Peer Review
No Reliance	18.22	13.62
Reliance	29.76	-6.85

Peer Review Timing = Timing of peer review, 1 or 3 periods
 Reliance = Preference for high quality

^aThe p-values indicated are for a directional (one-tailed) test of significance.

^bCell means represent average profits of auditors providing low quality investigations less average profits of auditors providing high quality investigations.

CHAPTER 6 SUMMARY AND CONCLUSIONS

Summary of the Study

The hypotheses developed in Chapter 3 predicted that peer review would have an effect on the quality and price of audit services, the allocation of market surplus between buyers and auditors and the total market surplus generated, only in settings where high quality auditing services were demanded. It was also predicted that the timing of the peer review process would impact the affect of peer review. In addition, a hypothesis was developed to examine the auditor's willingness to provide consistent high quality auditing services when utilizing peer review.

To test these hypotheses, the experiment described in Chapter 4 was conducted. Student subjects participated in a controlled experimental market setting where the true purpose of the study was disguised. The study was conducted over a short period of time, two weeks, to minimize information transfer between participants. The markets were structured to comply with the precepts of experimental economics where the subjects earn cash compensation based on their decisions made within the experimental setting.

Summary and Discussion of Results

The results of this study indicate that the information provided by the peer review process is useful to buyers in assessing the quality of services they are

receiving. The results suggest that the heterogeneous demand for audit quality creates a disparate valuation of the peer review process. In markets with no reliance costs, where buyers were not concerned with auditor reporting accuracy, there was no desire to identify high quality providers. In these markets the peer review process did not significantly affect the quality or price of audits provided, or the generation or allocation of market surplus within the markets.

In markets with reliance costs, the information provided by the 1-year peer review process led to a reduction in the information asymmetry regarding audit quality that increased the quality of audits provided in the market. Additionally, allocative efficiency and market efficiency were improved. The 3-year review process currently utilized within the profession did not significantly alter the market results from the non-peer reviewed markets.

The timing of the peer review significantly affected auditor "honesty". Markets with the 3-year peer review incurred significantly higher levels of shirking over the 1-year peer reviewed markets.

These results imply that the peer review process has the potential to address regulator's concerns regarding the quality of the attest function but that the timeliness with which the information is received is critical. Support is also provided for the imposition of mandated peer review to improve the audit quality provided within the accounting profession. In markets where buyers had reduced valuations of audit quality, or no reliance costs, they were unwilling to pay the fees required to motivate and sustain high quality audit services. Additionally, in markets with reliance costs

where high quality was demanded, while buyers were willing to pay higher prices, the absence of quality differentiating information in markets with no peer review allowed auditors to provide low quality services at high prices. The results of this study support the ability of the peer review process to provide quality differentiating information to buyers of audit services that improves their ability to purchase high quality auditing services, if desired.

Peer review could be viewed as the profession's response to the potential agency relationship between the purchaser of audit services and the ultimate end user of audit services. Managers may have different levels of reliance costs than investors, which creates an inconsistency between their respective valuations of audit services. Mandated peer review could be used to control the managers' decisions by removing the low quality auditor from the market. In essence, regulators are trying to protect the end user of the audited financial statement even if it is more costly to management. This is consistent with results from extant economics literature which show that the benefits from increased minimum quality standards are not distributed equally to market participants. High quality providers and demanders benefit from increased quality standards at the expense of market participants who provide or demand lower quality services (e.g., Leland [1979] and Shapiro [1983]).

Limitations

Several limitations are inherent in the research design used in this study. First, an experimental laboratory market necessarily abstracts from the external market. In laboratory settings only the critical decision variables are theoretically developed and

utilized. To the extent that significant variables were excluded, the ability to make inferences to settings outside the laboratory setting is compromised. Every variable which affects decision making regarding the auditor selection process obviously can not be incorporated in an experimental setting. This would make the markets too complex. The strength of laboratory markets is the ability to control for confounding variables that are not of interest to a particular study. However, these same variables, by their exclusion, reduce the generalizability of the experimental results.

Second, the use of college students, who might make different decisions than experienced auditors, managers, and business owners/investors, could lead to different results than would be derived in the auditing market. Given that the experimental design does not require any knowledge regarding the institutional variables within the auditing market, this effect should be minimal. Notwithstanding these limitations, the experimental laboratory markets framework provides an effective means to study issues which are hopelessly obscured by confounding variables in the empirical markets.

Future Research

Future research should utilize multiple methods from experimental and behavioral perspectives in an attempt to isolate which form peer review should take to achieve the optimal cost/benefit relationship for auditors and buyers. Specific areas that could be examined include the incorporation of a third party to the audit purchase decision to play the role of the manager who purchases the audit that is separate from the investor who utilizes the audit report. This could isolate the effects of having the

audit purchased by the manager when the audit report is actually used by the investor. In this light, peer review could be viewed as the profession's response to the potential agency relationship between the purchaser of audit services and the ultimate end user of audit services. Managers may have different levels of reliance costs than investors which creates an inconsistency between their respective valuations of audit services.

Future studies should also examine conditions that might produce low-balling behavior by auditors as this finding is prevalent in the extant empirical research (e.g., Francis and Simon [1987] and Ettredge and Greenberg [1990]). In the settings used in this study, the audit was the sole monitor of the true state of nature which increased buyer willingness to pay higher fees, even in settings with no information about audit quality. This reduced the auditors need to initially price their services below cost. Future research could examine similar settings to this study with additional monitors of the true state of nature available to buyers to see if this alters auditors behavior regarding the pricing of high quality audit services.

A possible effect that is not investigated by this research is the influence of audit quality on management effort. If management is confident that it's diligent efforts will be accurately reported by the audit this might increase managers' incentives to exert more effort. This research exogenously provided probabilistic information about the state of nature to buyers to assist in their valuation of audit services and does not consider their incentives regarding the accurate reporting of the true state of nature. Future research could examine manager's incentives to purchase accurate

reporting services based on their private information about the true state of nature and their effort level.

APPENDIX A EXPERIMENTAL MATERIALS

The materials reproduced in this appendix were given to subjects assigned to the experimental settings at indicated in Figure 3. The materials are presented in the following order: (1) consent form; (2) general instructions for all participants; (3) player specific information; (4) experimenter's analysis report information which was distributed and read aloud at the end of period 15 in each experiment; (5) startup instructions for practice periods (6) startup instructions for experiment; (7) pre-experimental questionnaire; (8) post-experimental questionnaire; and (9) supplemental questionnaire used for assessment of subjects risk preferences.

CONSENT FORM

This experiment is being conducted by Jeff L. Payne, Ph. D. Candidate, at the University of Florida. My campus address and phone are Business 267, Fisher School of Accounting, 392-0155. This is an experiment in the economics of market decision making. You are free to withdraw from the experiment at any time and will be paid any compensation earned up to that point. You do not have to answer any question that you do not wish to answer. Although you are guaranteed to earn \$ 7 for your participation, most subjects earn between \$15 and \$35 for 2-3 hours of participation.

This experiment will be conducted on computer terminals. No special skills are required to be able to participate in this experiment. Before the experiment begins you will be provided with the information and instructions you will need to understand the mechanics of the experiment. It is important that you follow the instructions carefully. To ensure that 8 participants were present for this experiment, 12 "slots" were available on each sign-up sheet. If more than 8 participants are present the participants who will be allowed to continue will be determined by random draw. The remaining participants will be paid \$7.00 and excused from the session.

At the end of the experiment, when you receive your cash payment, you will need to sign a payment report showing that you received the payment indicated. For purposes of the experiment, your identity will remain private information and you will only be identified by your participant number should you agree to participate in this experiment. All cash payments will be made in a sealed envelope so that other participants will not know how much money you made.

If you agree to participate in this experiment please read and sign the following:

I have read and I understand to procedure described above. I agree to participate in the procedure and I have received a copy of this description.

Signature

Date

Approved for use through February 28, 1996

GENERAL INSTRUCTIONS FOR ALL PARTICIPANTS

Note: This appendix copies verbatim the laboratory market instructions read to experimental participants. The actual instructions were printed using a large type font, with boldface where appropriate for emphasis. Each participant received that same set of instructions.

Thank you for your participation in this experiment!

There are 3 phases to today's session:

Phase I

1. You will receive a set of general instructions which will describe the experiment you will participate in today (all participants will receive the same set of general instructions).
2. A 10 - 15 question questionnaire will be administered to ensure that all participants understand the instructions for the game and how their decisions can affect their earnings. After the questionnaire has been completed and all questions have been answered, participants will be randomly assigned to be either buyers or sellers and will be escorted to the appropriate computer station to begin the experiment.
3. A computer instruction and practice period will be completed to familiarize you with the experimental setting and provide a forum for questions about participation in the experiment. Input sheets will be provided to assist you in understanding the rules of the game. Note that the values used during this practice session in no way relate to the values to be used in the actual experimental setting.

Phase II

Experimental Session

In this phase the actual experiment will be conducted. The experiment will continue until you are instructed by the experimenter to stop. Each experimental period will consist of the several steps explained in the general and participant specific instructions.

All participants will be paid the compensation earned during the experiment at the end of the experimental session. Earnings will be determined as explained in the instructions provided.

Phase III

Conclusion of Experiment

At the end of the experiment each participant will be asked to complete a questionnaire about the experimental session. This will contain a few short questions about your background and evaluation of the experimental settings.

Upon completion of the questionnaire, participants will be paid in cash for their accumulated earnings from the experiment and dismissed. The cash payment will be in a sealed envelop to maintain privacy. Please return all experimental materials to the experimenter at this time.

FINAL NOTE

Please do not discuss this experiment with the other participants, or any other person at any time during the experimental session or thereafter. Do not compare payments amounts or strategies. It is very important for future experiments of this type at the University of Florida that each participant make their own decisions and not be influenced by conversations with those who have previously participated in this or other similar experiments. Additionally, each experiment setting is different and the strategies that produce the highest earnings in one setting are not necessarily the optimal strategies in the other settings. Therefore, discussing your strategies with other players can reduce their ability to make optimal decisions.

Thank you again for your participation!

General Instructions

Everything contained in these instructions and everything you hear in this session is an accurate representation of the experiment you will be involved in. This is not a test of classroom knowledge. This is an experiment in economic decision making. Be sure to ask any questions that you may have during this instruction period and ask for assistance at any time during the experimental session. Given the close proximity of the computer stations, please try to minimize your verbal and physical reactions to information received during the experimental session.

The instructions that follow describe a market experiment in which participants earn money by making certain decisions. By participating in this experiment, the amount of money you earn will depend upon the decisions you make. The nature of these decisions will depend on whether you play the role of a buyer or seller.

The following information and the attached diagrams will explain the sequence which will be followed during today's experimental session. Please carefully review these instructions and the related diagrams as the experimenter reads them aloud. The experimenter will provide you with the opportunity to ask any questions that you might have before the experiment begins. Feel free to make notes on these instructions which might help you during the experimental session. You can refer to these instructions at any time during the execution of the experiment.

There are three player "types" (or roles) in this experiment, buyers, sellers, and the experimenter. You can only be assigned to the role of a buyer or a seller.

Sellers

Sellers increase their cash balances by selling investigation services to buyers. Sellers can provide "high" investigation services or "low" investigation services. High investigations are more costly to the seller than low investigations. All sellers who provide the same quality of service will incur the same investigation cost.

If a seller performs a High investigation s/he will have a 90% chance of accurately reporting to the experimenter the true value of a buyer's experimental unit (This will be explained in more detail later). If a seller performs a Low investigation s/he will have a 50% chance of accurately reporting the true value of the unit. Therefore, a seller who provides a high investigation will have a greater opportunity to accurately report the actual value of the unit. Sellers will select the investigation level they will provide at the beginning of each period but can change investigation levels between experimental periods if they choose to do so.

Example: Suppose the actual unit value is high. A seller who performs a high investigation can expect to report a high value for the unit 9 times out of 10. Similarly, if the actual unit value is low, a seller who performs a high investigation can expect to report a low value for the unit 9 times out of 10. Suppose the actual unit value is high, a seller who performs a low investigation can expect to report a high value for the unit 5 times out of 10. Similarly, if the actual unit value is low, a seller who performs a low investigation can expect to report a low value for the unit 5 times out of 10.

Sellers will make offers to sell their investigations to buyers. Sellers will make the same offer to all buyers for each experimental period. Each seller can sell their investigation services to as many buyers as they can successfully contract with. Therefore, it is possible for some sellers to be hired by more than one buyer, or for a seller to not be hired by any buyer, during an experimental period.

If a seller is hired by more than one buyer, the seller will generate a separate report for each buyer. The seller must report the unit's level determined from their investigation. They will not be allowed to report a different value than their investigation revealed.

Buyers will be able to observe which seller is making the offer and the amount of the offer before making a purchase decision. Buyers will not be able to directly observe the level of investigation that the seller has elected to provide.

The seller's cash earnings from the experiment will be calculated as follows:

Payments received from buyers for investigation services
- Cost in investigations
<hr/>
Seller's net cash earnings
<hr/>

Refer to Figure 1 now.

Buyers

Buyers will receive an experimental commodity unit from the experimenter at the start of each period. Buyers do not have to pay for this unit. You can think of these units as some arbitrary product. These are not actual, physical units. They exist in this experimental setting only.

The unit's can have a value of high or low. The buyer's will be informed that the unit has a _% chance of being high at the start of the experiment. This probability will remain unchanged during the experiment.

Example: If the chance of a unit having a high value is 99% then the buyer can expect the unit's actual value to be high in 99 out of 100 experimental periods and low in 1 out of 100 experimental periods.

The buyer will receive a cash payment from the experimenter based on the reported value of the unit. To determine the reported value of the unit the buyer must purchase an investigation from a seller to report on the value of the unit. The buyer will then receive compensation from the experimenter based on the seller's report. If the unit's reported value is high the experimenter will pay the buyer more than if the unit's reported value is low. The experimenter will not pay the buyer unless he receives a seller's report on the buyer's unit.

The actual value of the unit is determined by a random process determined by the computer based on the unit's likelihood of being high as discussed earlier. This means that the seller's investigation report on the unit's value will be affected by their level of investigation and the unit's actual value.

Example: The unit's actual value is determined to be high by the computer based on a random generation process. The seller's ability to report a high value is dependent upon their level of investigation, High or Low. Therefore it will be possible for the seller to report a unit value of low, even though the actual value of the unit was high. Likewise, the seller might report a unit value of high when the actual value is low.

Note: The following wording and Figure 2 were used in settings with no reliance costs.

The actual value of the unit received each period will not be observed by the buyers or sellers during the game.

The buyers' earnings from the experiment will be calculated as follows:

Payment received from experimenter based on reported unit's value
- Payment to seller for investigation services

Buyer's cash earnings
=====

Refer to Figure 2 now.

Figure 2

					Expected Values Seller's Investigation Level		
					L	H	
					(Cents)		
					EV	5600	8000
P	Sel #	Fee	Rpt	Value	Cash Chg	Cash Bal	
1	3	6000	H	15000	9000	9000	

* OFFERS *

Sel #	Exp Rpt ¹	Offer
1	H	8000
2		9000
3	L	6000
4	L	5000

¹This information was available after period 15 only.

Description:

P	- Experimental period
Sel #	- The seller hired
Fee	- The amount paid to the seller
Sel Rpt	- The seller's report
Value	- The value of the unit based on seller's report
Cash Chg	- This is an your cash change for the experimental period
Cash Bal	- This is your cash balance at the end of the period

Note: The following wording and Figures 2 and 3 were used in the settings which included reliance costs.

The actual value of the unit received each period will not be observed by the sellers. The buyers will observe the unit's actual value for each period at the end of the game when the seller's reports are compared to the actual unit value by the experimenter.

As noted previously, the sellers' ability to accurately report the true value of the unit is based on the level of investigation they provide. Recall that "high" investigations have a greater probability of reporting the true value of the unit than "low" investigations. This is important because the experimenter can reduce the buyer's earnings with a "penalty" for misreporting. This penalty will be charged to the buyer for all experimental periods where the seller's report indicated the unit's value was high when the unit's actual value was low. The penalty will be deducted from the buyer's earnings. If the report is low but the unit's actual value was high, the buyer will be paid the reduced amount for the low report but will not incur a penalty from the experimenter. The penalty will be assessed at the end of the game based on the experimenter's comparison of the each seller's report with the respective unit's actual value.

Refer to Figure 2 now.

Figure 2

Per	Actual Unit Value	Reported Unit Value	Payment Received	Investigation Cost	Penalty	Net	Cash Balance
Initial Endowment ==>							5000
1	H	L	9000	7000	0	2000	7000
2	L	L	9000	6000	0	3000	10000
3	H	H	15000	8000	0	7000	17000
4	L	H	15000	9000	12000	-6000	11000

Given that buyers will not be able to determine the number of penalties they have incurred until the end of the game, the buyers earnings information will be adjusted for the expected value of the penalty in all periods when they receive a high report. The expected value of the penalty will be larger if the seller provided a low investigation to reflect the fact that they are less likely to accurately report the unit's actual value.

Note that the buyer cannot incur a penalty in any given period if they have not purchased a seller's investigation. In this instance they would not have received a report or experimenter's payment for that period. Therefore, buyers do not have to purchase an investigation from a seller.

The buyers' earnings from the experiment will be calculated as follows:

- Payment received from experimenter based on reported unit's value
- Payment to seller for investigation services
- Penalty

Buyer's cash earnings

Refer to Figure 3 now.

* Note: Your actual cash balance should lie between these two amounts and will be closer to one or the other based on the level of investigations provided by the seller's hired.

At the end of each experimental period all buyers and sellers will be informed of the successful offers for investigation services for that period. This information will indicate the amounts paid by buyers who purchased an investigation.

Example: The computer screen will display the following:

Successful offers for the last period were (in "cents"):

1500 1725 1956 1923

At this time every player will know the amounts paid to sellers for investigation services for that period. However, the identities of the contracting buyers and sellers, the investigation quality, or the reported value of the unit will not be revealed.

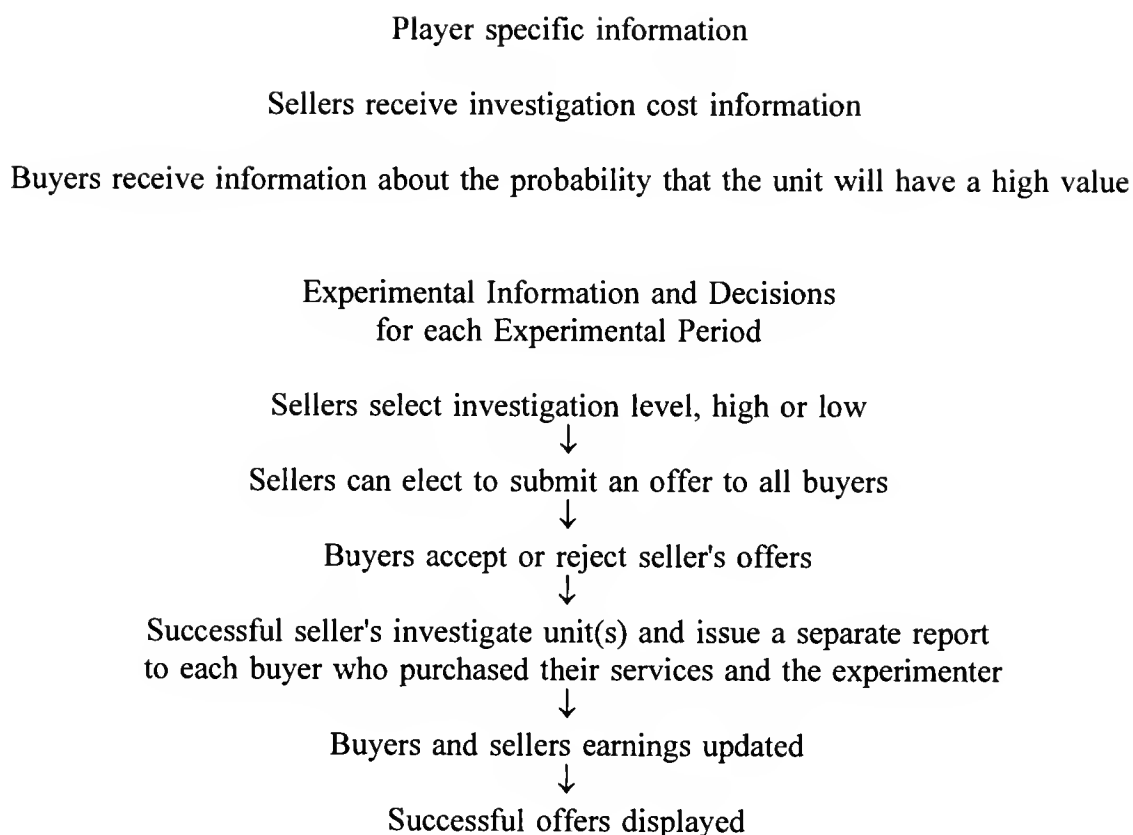
Endowments

Additional cash compensation will be available to buyers and sellers during the experiment. Both participant types will receive an endowment from the experimenter for each experimental period, an initial lump sum, or both. All buyers will receive the same payments from the experimenter. Similarly all sellers will receive the same payments from the experimenter. However, it is possible that the amounts paid to buyers will not be the same as the amounts paid to sellers. This amount will be added to the participants net earnings from the experiment.

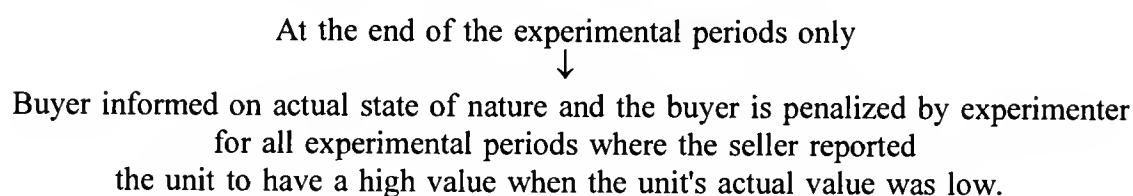
Example: The player-specific instructions might indicate that the player will receive 2000 "cents" at the start of the experiment and 1000 "cents" for each experimental period completed. This endowment will be added to the players earnings and will be paid to them at the end of the experiment.

Refer to Figure 3 (no reliance settings) 4 (reliance settings) now.

Figure 3 (4)



Note: The following was added for settings with reliance costs.



PLAYER SPECIFIC INFORMATION

Information Sheet for Buyer

THIS IS YOUR OWN PRIVATE INFORMATION. PLEASE DO NOT REVEAL THIS INFORMATION TO ANY OTHER PARTICIPANT IN THE EXPERIMENT DURING THE EXPERIMENTAL SESSION OR AFTER.

1. You will be given an initial endowment of 300 cents. This amount will be added to your earnings from the experiment. However, note that if you incur a loss from your contractual decisions during the experiment, this loss will be subtracted from this initial endowment. Remember that you are guaranteed a minimum payment of \$ 7 for participating in this experiment.
2. Valuation of reported unit value received from sellers:

For each investigation purchased from a seller, the experimenter will pay you:

- 600 cents if the reported value is high
- 300 cents if the reported value is low

Note: The following information was added for settings with reliance costs.

3. **Penalty:** At the end of the experiment you will receive an information screen which indicates the actual unit value and the reported unit value for each experimental "period". For all periods where the reported value was high but the true value was low you will be assessed a penalty of 900 cents. This penalty will be deducted from your earnings during the game. To assist you in determining the impact of this penalty, estimated cash balances for high and low investigations will be provided during the experiment to allow you to assess your potentially liability. If the seller provided a low investigation your expected penalty is 450 cents ($900 * 50\%$) since at this investigation level the seller has a 50% chance of accurately reporting the unit's actual value. Therefore, if the unit's actual value is low, the seller's report will be high 50% of the time. Similarly, if the seller provided a high investigation you expected penalty is 90 cents ($900 * 10\%$) since at this investigation level the seller has a 90% chance of accurately reporting the unit's actual value. Or if the unit's value is low the seller's report will be high 10% of the time.

4. The unit has a 40% chance of having an actual value of high each period. Therefore the unit has a 60% chance of having an actual value of low each period. Remember that a high investigation from a seller has a 90% chance of reporting the true value of the unit. Similarly, a low investigation from a seller has a 50% chance of reporting the true value of the unit. Based on these probabilities your computer screen will indicate the expected values to be earned from contracting with sellers providing high and low investigations. These expected values are adjusted for the expected penalties to be incurred for each period based on the seller's investigation level. The expected values for each period are as follows:

Note: The information in parentheses was used for settings with reliance costs.

(Net of Penalties)			
Seller's			
Investigation			
Level			
	L	H	
(EV)		450 (180)	426 (372)

This means that if a seller you hired performs a 'L' investigation, you can expect their investigations will allow you to earn 180 cents for each experimental period. If you pay more than 450 (180) cents for an investigation in that period, if the seller provides a low investigation, you can lose money. Similarly, if a seller you hired performs a 'H' investigation, you can expect their investigations will allow you to earn 426 (372) cents for each

experimental period. If you pay more than 426 (372) cents for an investigation in that period, and the seller's investigation is high or low you can lose money. These values represent the expected amount the experimenter will pay based on the seller's investigation level. Your investigation fees will be taken from this amount. Remember the seller's ability to report to actual unit's value is affected by their level of investigation.

5. At the end of the experiment you will be paid 25% (70%) of your actual "cents" earned.

Information for Seller

THIS IS YOUR OWN PRIVATE INFORMATION. PLEASE DO NOT REVEAL THIS INFORMATION TO ANY OTHER PARTICIPANT IN THE EXPERIMENT DURING THE EXPERIMENTAL SESSION OR AFTER.

1. For each experimental period you will be given an endowment of 60 cents even if you are unable to successfully contract with a buyer. These amounts will be added to your earnings from the experiment. However, note that if you incur a loss from your contractual decisions during the experiment, this loss will be subtracted from these endowments. Remember that you are guaranteed a minimum payment of \$ 7 for participating in this experiment.
2. Cost of investigation sold to buyers:

Each time you sell an investigation to a buyer you will be charged for the level of investigation you provide as follows:
 - High investigation: 200 cents
 - Low investigation: 100 cents
3. At the end of the experiment you will be paid 75% of your actual "cents" earned.

EXPERIMENTER'S ANALYSIS REPORT

Note: The following instructions were for the settings with the 1 period review process.

Additional information about sellers' investigation decisions:

Starting with the next period the seller's in this experiment will be able to contract with the experimenter to receive an analysis of their investigation decisions. The seller does not have to pay for this analysis. The analysis will indicate the level of investigations provided by each seller for the period covered by the analysis process. The initial analysis will cover one period, and subsequent analyses will be updated every subsequent period. If the investigations performed by a seller were "high" during the period examined, the analysis report will be H. If the investigations performed by a seller were "low" during the period examined, the analysis report will be 'L'. Sellers elect to remain in the process every period after their initial report. If a seller exits the analysis process at any time, the experimenter's report will not be available to prospective buyers. The experimenter will always truthfully report the level of investigations observed. The following examples will explain the process. Please feel free to ask questions at any time.

Example 1: Initial Report:

A seller enters the analysis process in any period . At the end of that period the seller will receive a report based on the level of investigations sold during that period. Note that the seller can only receive an analysis if they have provided an investigation for the period under review. If the seller does not contract with any buyers during this initial period they will have the option of staying in the analysis process in subsequent periods. If the seller receives an experimenter's report, this information will be displayed with the seller's offers in the subsequent period to prospective buyers. If the analysis report is H this means the seller provided high investigations for the last period. If the report is L this means that the seller provided low investigations in the last period.

Example 2: Continuing Reports:

After the initial analysis the seller will have the option of remaining in the analysis process in each subsequent period. For all subsequent periods the analysis will be updated for investigations performed by the seller during the respective period. If the analysis report is H this means the seller provided "high" investigations for the period. If the report is L this means that the seller provided "low" investigations for the period.

If the seller exits the analysis process at any time, they will no longer show an experimenter's report with their offers for investigation services. However, sellers can re-enter the analysis process in a subsequent period if they choose to do so.

Example 3

Period	Seller's Investigation Level	Experimenter's Report
X1*	H	N/A **
X2***	H	H
X3	H	H
X4	H	H
X5	H	H
X6	H	H

(Assumes seller sells investigations in each period)

- * X1 represents the first period the seller request an analysis of their investigation process.
- ** The experimenter's analysis is performed at the end of the first period. The experimenter's report of 'H' in period X2 is based on the level of investigations provided in period X1.
- *** The second analysis will be performed by the experimenter here and will examine the prior period (X2).

Example 4

Period	Seller's Investigation Level	Experimenter's Report
X1	H	N/A
X2	L	H
X3	H	L
X4	H	H
X5	H	H
X6	L	H
Seller elects to discontinue experimenter's analysis at the start of the 7Th period		
X7	L	(no report)
Seller re-enters reporting process in period X8.		
X8	H	N/A
X9	H	H*

(Assumes seller sells investigations in each period)

*The experimenter's report for this period is updated based on the last investigation sold in period X8.

Example 5

Experimenter's Period	Investigation Sold	Seller's Investigation Level	Report
X1	Y	H	N/A
X2	Y	L	H
X3	N	H*	L
X4	N	H*	L
X5	Y	H	L
X6	N	H	H
X7	N	H	H
X8	Y	H	H

* In these periods the experimenter's report will not be updated to 'H' because the seller did not sell any investigations for the periods under review. The experimenter's report is updated in period X6 when a high investigation is provided and an investigation is sold.

Example 6

Period	Investigation Sold	Seller's Investigation Level	Experimenter's Report
X1	N	L*	N/A
X2	N	H*	' '
X3	N	L*	' '
X4	Y	H	' '
X5	Y	H	H

* In these periods the experimenter's report will not be updated to 'H' because the seller did not sell any investigations for the periods under review. The experimenter's report is updated in period X4 when a high investigation is provided and an investigation is sold.

Note: The following instructions were for the settings with the 3 period review process.

Additional information about sellers' investigation decisions:

Starting with the next period the seller's in this experiment will be able to contract with the experimenter to receive an analysis of their investigation decisions. The seller does not have to pay for this analysis. The analysis will indicate the level of investigations provided by each seller for the period(s) covered by the analysis process. The initial analysis will cover one period, and subsequent analyses will be updated every third period. If all the investigations performed by a seller were "high" during the period examined, the analysis report will be H. If any investigations performed by a seller were "low" during the period examined, the analysis report will be 'L'. Sellers elect to remain in the process every third period after their initial report. If a seller exits the analysis process at any time, the experimenter's report will not be available to prospective buyers. The experimenter will always truthfully report the level of investigations observed. The following examples will explain the process. Please feel free to ask questions at any time.

Example 1: Initial Report:

A seller enters the analysis process in any period . At the end of that period the seller will receive a report based on the level of investigations sold during that period. Note that the seller can only receive an analysis if they have provided an investigation for the period under review. If the seller does not contract with any buyers during this initial period they will have the option of staying in the analysis process in subsequent periods. If the seller receives an experimenter's report, this information will be displayed with the seller's offers in the subsequent period to prospective buyers. If the analysis report is H this means the seller provided high investigations for the last period. If the report is L this means that the seller provided low investigations in the last period.

Example 2: Continuing Reports:

After the initial analysis the seller will have the option of remaining in the analysis process every third period. For all subsequent periods the analysis will be updated for investigations performed by the seller during the respective period. If the analysis report is H this means the seller provided "high" investigations for all investigations sold during the 3 periods. If the report is L this means that the seller provided at least one "low" investigation during the 3 periods.

If the seller exits the analysis process at any time, they will no longer show an experimenter's report with their offers for investigation services. However, sellers can re-enter the analysis process in a subsequent period if they choose to do so.

Example 3

Period	Seller's Investigation Level	Experimenter's Report
X1*	H	N/A **
X2	H	H
X3	H	H
X4	H	H
X5***	H	H
X6	H	H

(Assumes seller sells investigations in each period)

- * X1 represents the first period the seller request an analysis of their investigation process.
- ** The experimenter's analysis is performed at the end of the first period. The experimenter's report of 'H' in period X2 is based on the level of investigations provided in period X1.
- *** The second analysis will be performed by the experimenter here and will examine the prior three periods (X2,X3,X4).

Example 4

Period	Seller's Investigation Level	Experimenter's Report
X1	H	N/A
X2*	L	H
X3	L or H	H
X4	L or H	H
X5**	H	L
X6	H	L
X7	H	L
X8***	H	H

(Assumes seller sells investigations in each period)

- * The first analysis will be performed by the experimenter here and will examine the prior period only.
- ** The second analysis will be performed by the experimenter here and will examine the prior three periods (X2,X3,X4).
- *** The third analysis will be performed by the experimenter here and will examine the prior three periods (X5,X6,X7).

So as indicated, the analysis is performed in the first year and undated every three periods thereafter, as long as the seller elects to remain in the analysis process.

NOTE: If the seller's initial investigation level in period X1 is L then they will receive a report of L for the next three periods until the experimenter's analysis is performed in period X4.

Example 5

Experimenter's Period	Investigation Sold	Seller's Investigation Level	Report
X1*	N	H	N/A
X2	Y	L	' '
X3	N	H*	L
X4	N	H*	L
X5	N	H*	L
X6	Y	H	L

* In these periods the experimenter's report will be updated to 'H' because the seller did sell at least one investigation for the period under review. The experimenter's report remains 'L' in period X6.

STARTUP INSTRUCTIONS FOR PRACTICE PERIODS

Instructions for Practice Period

BUYER

- Type buyer at the G:\PASCAL prompt and press enter
- Enter the Experiment I.D. : Z
- Enter participant number : 1
- Wait for further instructions
- Press ENTER when instructed to do so by experimenter

Read the screen that is displayed

- Press any key to continue

PERIOD 1

Initial Screen

The initial screen which is displayed indicates the expected values to be received from the purchase of investigator services and should be interpreted as explained in the instruction session.

During this instructional period if the unit is reported to have a High value you will receive 5 cents. If the unit is reported to have a Low value you will receive 2 cents.

The computer screen will display "Waiting for others to continue" while the sellers make their offers.

Second Screen

The seller's offers will be displayed for you in the bottom right hand portion of the screen.

Please select seller # 4 now.

- Press Enter
- Note that the screen displays the cost of the seller's services that you have selected.
- The screen will also display your expected value from purchasing investigation services from this seller.
- Press 'F', or any key other than 'C', to examine the expected value from purchasing another seller's investigation. Press seller 1 at this point.

Press 'C' to confirm you decision.

Third Screen

Waiting for seller investigation report.

Fourth Screen

The seller's report, if any, will be displayed and your cent balances will be updated.

- Press any key to continue when prompted.

Fifth Screen

The successful offers for the last period will be displayed for your review.

- Press any key to continue when prompted.

Sixth Screen

You will be asked to press any key to move to the next period.

PERIOD 2

This period will progress the same as the last period up through the sixth screen. Select any seller you wish when prompted by the computer.

Seventh Screen

The game will now conclude.

Eighth Screen

This shows the cash balance which you will be paid by the experimenter.

INSTRUCTIONS FOR PRACTICE PERIOD

BUYER (Penalty setting)

- Type buyer at the G:\PASCAL prompt and press enter
- Enter the Experiment I.D. : Z
- Enter participant number : 1 (possible values 1-4)
- Wait for further instructions
- Press ENTER when instructed to do so by experimenter

Read the screen that is displayed

- Press any key to continue

PERIOD 1

Initial Screen

The initial screen which is displayed indicates the expected values to be received from the purchase of investigator services and should be interpreted as explained in the instruction session.

During this instructional period if the unit is reported to have a High value you will receive 5 cents. If the unit is reported to have a Low value you will receive 2 cents.

The computer screen will display "Waiting for others to continue" while the sellers make their offers.

Second Screen

The seller's offers will be displayed for you in the bottom right hand portion of the screen.

Please select seller # 4 now.

- Press Enter
- Note that the screen displays the cost of the seller's services that you have selected.

- The screen will also display your expected value from purchasing investigation services from this seller.
- Press 'F', or any key other than 'C', to examine the expected value from purchasing another seller's investigation. Press seller 1 at this point.

Press 'C' to confirm your decision.

Third Screen

Waiting for seller investigation report.

Fourth Screen

The seller's report, if any, will be displayed and your cent balances will be updated.

- Press any key to continue when prompted.

Fifth Screen

The successful offers for the last period will be displayed for your review.

- Press any key to continue when prompted.

Sixth Screen

You will be asked to press any key to move to the next period.

PERIOD 2

This period will progress the same as the last period up through the sixth screen. Select any seller you wish when prompted by the computer.

Seventh Screen

The game will now conclude.

Eighth Screen

This is a recap of the game and a comparison of the actual and reported unit values. For all periods where the unit had an actual value of low but a reported value of high you will be assessed a 7 cent penalty.

Ninth Screen

This shows the cash balance which you will be paid by the experimenter.

Instructions for Practice Period

SELLER

- Type SELLER at the G:\PASCAL prompt and press enter
- Enter the Experiment I.D. : Z
- Enter participant number : 1 (possible values 1-4)
- Wait for further instructions
- Press ENTER when instructed to do so by experimenter

Read the screen that is displayed

- Press any key to continue

PERIOD 1

Initial Screen

The initial screen which is displayed indicates your costs to provide "high" or "low" investigations.

Select investigation level H

- Press Enter
- Note that the computer prompts you with the cost you have selected.

Press 'C' to confirm your decision.

Second Screen

- Do you wish to enter an offer for investigation services this period? Y
- Press Enter
- Enter offer in cents 2

Note: The computer will prompt you that you have entered an offer that is below your costs. If you press C this will be accepted. At this time Press any other Key to reenter an offer of 4.

- Press Enter
- Note that the computer prompts you with the following:

** See you offer, cost, and net information below **
- Press 'C' to confirm you decision.

Third Screen

The computer will inform you of the buyers which purchased your investigation services.

- Press any key to continue

Fourth Screen

The computer will indicate what you reported the unit value to be.

- Press any key to continue

Fifth Screen

The successful offers for the last period will be displayed for you review.

- Press any key to continue

Sixth Screen

You will be asked to press any key to move to the next period.

Period 2

This period will progress the same as the last period up through the sixth screen. Make your own decisions for this period.

Eighth Screen

The game will now conclude.

Ninth Screen

This shows the cash balance which you would be paid by the experimenter if this were not a practice session.

STARTUP INSTRUCTIONS FOR GAME

Instructions for Game

Seller

- Type SELLER at the G:\PASCAL prompt and press enter
- Enter the Experiment I.D. : G (possible values A - L)
- Enter participant number : 1 (possible values 1 - 4)
- Wait for further instructions
- Press ENTER when instructed to do so by experimenter

Read the screen that is displayed

- Press any key to continue

Instructions for Game

Buyer

- Type BUYER at the G:\PASCAL prompt and press enter
- Enter the Experiment I.D. : G (possible values A - L)
- Enter participant number : 1 (possible values 1 - 4)
- Wait for further instructions
- Press ENTER when instructed to do so by experimenter

Read the screen that is displayed

- Press any key to continue

PRE-EXPERIMENTAL QUESTIONNAIRE

- T F 1. The amount a buyer receives from the experimenter is based on the seller's investigation report, not the actual value of the unit.
- T F 2. If the seller chooses a low investigation the unit's reported value will always be low.
- T F 3. The seller must provide the same level of investigation services to all buyers engaged during the same experimental period.
- T F 4. The same seller can provide different levels of investigation services in separate experimental periods.
- T F 5. The actual value of the unit is determined by the buyer.
- T F 6. The endowment amounts received by buyers and sellers from the experimenter are actual cash amounts which will be added to the buyer's/seller's cash earnings from the experiment.
- T F 7. The buyer receives the same compensation from the experimenter regardless of the unit's reported value.
- T F 8. You can be only be assigned to the role of a seller or buyer.
- T F 9. The amount of money you can earn during this experiment is directly affected by the decisions you make during the experimental session.
- T F 10. The experiment will require you to draw on specific classroom knowledge and information.
- T F 11. The seller can make separate offers, of different amounts, to each prospective buyer for each period.
- T F 12. The buyer's expected value to be received from seller investigation services is based on the quality of investigation purchased and the actual value of the unit.

Note: The following was added for settings with reliance costs.

- T F 13. At the end of the experimental session, buyers will receive information about the unit's actual value for each experimental period. This information will be compared to the seller's investigation report received, if any. The buyer will be charged a penalty by the experimenter for all periods where the unit's actual value was low, and the investigation report was high.

POST-EXPERIMENTAL QUESTIONNAIRE

(Results from participant responses are analyzed in Appendix B.)

Note: Adequate spacing was provided for responses in experimental sessions.

Player Type (Seller or Buyer)

Player Number (1 - 4)

Current Educational Level: Junior Senior MBA MACC

Major: _____

1. Have you participated in prior experimental studies like this?
Yes_____ No_____
2. Please briefly describe you market strategy during the early periods of the experiment. (Before the Experimenter's analysis was available)
3. Please briefly describe your market strategy during the later periods of the experiment.(After the Experimenter's analysis was available)

On the following scales, please draw a slash at the point that best describes your response.

4. The degree to which you feel you were successful in capturing the most profit possible from this experiment.

Not successful at all

Completely Successful

5. To what degree did you want to perform well in this study?

Did not want to perform well Wanted to perform well

6. I found participating in this study to be

Very Unpleasant Very Pleasant

7. Did your decisions affect the amount of money you were able to earn?

Not at All Very much

8. Did you know other participants cash totals during the experiment?

Never All the Time

9. How much information did you have about the experiment before your participation that you did not receive from the experimenter?

Nothing Everything

10. Do you feel that the values used in the experimental instructions and during the practice period affected the amounts at which you were willing to negotiate for investigation services.

No Impact Significant Impact

11. Please indicate the one factor which you felt prevented you from being able to capture more profit from this experiment.

12. How did you utilize the experimenter's report on the sellers investigation services in your decision-making during the experiment?

Note: The following was added for settings with reliance costs.

13. How did the knowledge that a penalty could be assessed against the buyer at the end of the experiment affect your decision-making during the experiment?

SUPPLEMENTAL QUESTIONNAIRE

Experiment I.D. _____

Player Type (Seller or Buyer)_____

Player Number (1 - 4)_____

For each of the following 24 items, assume that you own a lottery ticket in which your chance of winning \$ 100 is stated in column A, and your chance of winning \$ 0 is stated in column B. In column C, please write the minimum price you would accept for your lottery ticket. Please consider each item separately.

<u>Item</u>	<u>Column A: Chance of winning \$ 100</u>	<u>Column B: Chance of winning \$ 0</u>	<u>Column C: How much would you accept for this ticket?</u>
1	50%	50%	\$ _____
2	20%	80%	\$ _____
3	85%	15%	\$ _____
4	10%	90%	\$ _____
5	40%	60%	\$ _____
6	70%	30%	\$ _____
7	75%	25%	\$ _____
8	55%	45%	\$ _____
9	30%	70%	\$ _____
10	45%	55%	\$ _____
11	90%	10%	\$ _____
12	65%	35%	\$ _____

13	15%	85%	\$ _____
14	60%	40%	\$ _____
15	95%	5%	\$ _____
16	35%	65%	\$ _____
17	25%	75%	\$ _____
18	80%	20%	\$ _____
19	5%	95%	\$ _____
20	62%	38%	\$ _____
21	37%	63%	\$ _____
22	28%	72%	\$ _____
23	73%	27%	\$ _____
24	53%	47%	\$ _____

APPENDIX B INTERNAL VALIDITY CHECKS

Internal validity requires a successful laboratory market and participant understanding of the experimental instructions and requisite decisions.

Successful Experimental Market Design

A successful laboratory market must be established. Smith [1982] outlines the precepts for a successful market. These precepts include: salience, or recognition that rewards are tied to behavior, dominance, or the belief on the participants part that the payment received is adequate to compensate to the subjective transactions costs, privacy, or no knowledge of other participants earnings, and non-satiation, or subjects prefer more rewards to less. These were checked by utilizing a post-experimental questionnaire completed by all participants. The responses were coded based on a seven point Likert scale. See appendix A part 8 for the questionnaire completed by participants.

To test salience participants were asked if they felt that their effort affected the compensation the received. In general they felt that their decisions affected the amount of money they were able to earn (mean score = 5.39, s. d. = 1.64).

Dominance is checked by a series of questions. First, did the participants desire to do well? This desire was the highest scored response on the questionnaire (mean 6.32, s. d. .99). Given that the participants had no prior dealings with the

experimenter, and were not currently enrolled in his class or that of any of his committee members, this desire to do well could be attributed to the dominance of the cash reward rather than to a desire to please the experimenter. Participants found the study to be pleasant to participate in (mean 5.45 s.d. 1.30) which should reduce subjective transactions costs incurred during participation.

Privacy of the experiment was checked by a questions concerning participants knowledge of how others were performing. Privacy primarily addresses the problem of equity between participants. Therefore, what is required is that the actual cash totals of other participants be unknown. The response (mean .28, s.d. .68) indicates that privacy was maintained during the experiment. This low score was facilitated by the use of a computerized games where participants were physically isolated from each other.

Prior knowledge of experimental conditions and decisions could affect participant behavior. This was examined by determining how much information each participant had about the experiment before their participation. The response (mean .221, s.d. 1.00) indicates that participants were not informed about the game before their participation. This indicates that the instructions to all participants to not communicate with others during or after the experimental setting were adhered to. In general, it appears the Smith's four criteria for a successful laboratory market have been fulfilled.

Participant Understanding of the Experimental Instructions

To ensure participants understanding of experimental instructions a pre-experimental questionnaire was completed at the conclusion of the instruction session. Based on participants responses and questions, it appeared as if all subjected understood the nature of the game they were to participate in. The further their understanding a practice period was conducted on the computer workstations to allow the participants to see how the game progressed and how their decisions would be recorded and their profits tabulated. This instructional period used artificially low values which did not affect participants decisions when the experiment was conducted (mean 1.80, s.d. 2.18). Overall, it appears as if the participants understood the experimental instructions and how the game would be played.

Post-Experiment Questionnaire
Internal Validity Checks
(N=96)

1. To what degree did you want to perform well in this study (Did not want to perform well - Wanted to perform well)?

Mean	6.32	Standard deviation	.99
------	------	--------------------	-----
2. I found participating in the study to be (Very unpleasant - Very pleasant)?

Mean	5.45	Standard deviation	1.30
------	------	--------------------	------
3. Did your decisions affect the amount you were able to earn (Not at all - Very much)?

Mean	5.39	Standard deviation	1.64
------	------	--------------------	------
4. Did you know other participants cash totals during the experiment (Never - All the time)?

Mean	.28	Standard deviation	.68
------	-----	--------------------	-----
5. How much information did you have about the experiment before your participation that you did not receive from the experimenter (Nothing - Everything)?

Mean	.22	Standard deviation	1.00
------	-----	--------------------	------
6. Did the values used during the experimental instruction and practice period affect the amount at which you were willing to negotiate to investigation services (No impact - Significant impact)?

Mean	1.80	Standard deviation	2.18
------	------	--------------------	------

APPENDIX C PLAYER'S STRATEGIES

The following presents for illustrative purposes the apparent strategies of experimental market participants by market setting to provide insights into the results presented in Chapter 5. These comments were taken directly from the post-experimental questionnaires completed by all participants. Only unique comments for each setting are listed.

No Reliance/ 1-year review

Strategy in early periods before peer review available:

Buyer: I went with the lowest bidders for the most part.

Buyer: Always chose the lowest price assuming this meant a low level of investigation.

Seller: Use high quality to try to build customer loyalty. However, the buyers were CHEAP!

Strategy in later periods after peer review available:

Buyer: I went with the lowest bidders for the most part.

Seller: I decided to severely undercut my competition to get sales.

Seller: I had to be a low price provider, I stayed low in order to compete.

Seller: Lowered quality so that I could compete.

How did you utilize the peer review report on the seller's investigation services?:

Buyer: I used it to determine the "honesty" of the seller. If he had a high bid in, and subsequently I saw that he had a low peer review report, I would question his integrity. Similarly, this would also enhance my reliance on a seller's bid if I found him to be dependable.

Buyer: Did not use it.

Seller: I thought buyers would buy from me if I had a good record. It didn't seem to have much effect.

Seller: I didn't think it had much affect on my selling

General Comments:

Seller: We dealt to much on prices. The buyers did not seem to care about high or low services as long as the price was real low.

No reliance / 3 -year review:

Strategy in early periods before peer review available:

Seller: Conduct low investigations priced at or near the cost of high investigations.

Buyer: Take to lowest offer

Strategy in later periods after peer review available:

Seller: I became frustrated because of dropping prices and profit margins.

Buyer: Take the lowest offer with either "L" or no peer review report.

How did you utilize the peer review report on the seller's investigation services?:

Seller: First, I did a high investigation to get a high report. Then I did 3 low investigations priced in the same range. After that, I did bargain basement jobs for bargain basement prices.

Seller: I tried to get H for my service report so buyers would buy my service, but I'd lose \$ because the buyers would not pay enough to cover the high investigation costs.

Buyer: I didn't utilize it at all.

Reliance / 1 -year review:

Strategy in early periods before peer review available:

Seller: Always used low quality investigations and tried to price them fairly high to give the impression I was at the low price end of high quality investigations. Looking for high margins vs. market share.

Buyer: To buy information that was competitively priced, but not too low.

Buyer: Early on, I simply took the lowest offers. There was little feedback about investigation quality so I felt safer with the lower prices.

Buyer: Buy low, don't know quality, so might as well buy a cheap one.

Buyer: Pay lowest price.

Strategy in later periods after peer review available:

Seller: The peer review provided an option to disclose my report to other buyers. The prices of other sellers was not quite as important as before.

Seller: Always used high quality investigations and tried to price them very consistently. Started at 285, price cutting started in round 20. Goal was market share, consistency.

Seller: At first, I chose a high investigations and decided it was a good idea to issue a report. Once my offer was accepted, I then tried to fool the buyers by buying a low investigation the next time. It didn't work.

Buyer: Tried to find seller who was consistently providing high quality investigations based on the peer review. Didn't mind paying premium if they were providing high quality investigations.

Buyer: Pay lowest price until someone demonstrated they were giving high quality reports. Until that point, low price always won.

Buyer: Picked sellers with the highest services rating with lowest cost. If no rating, too chancy.

Buyer: Stuck with sellers who consistently received high peer review reports.

Buyer: In the later periods, I went for the lowest cost provider with the high quality report. I knew this would maximize my earnings. I was burned once by seller 2, so I would only select from sellers 1, 3, or 4 in the remaining periods.

How did you utilize the peer review report on the seller's investigation services?:

Seller: I always opted to be reviewed. From that point, I always chose high investigations quality to communicate this fact with consistency to the buyers.

Buyer: I decided to buy services from the seller that consistently offered high quality.

Buyer: I used it to determine who might be best able to provide low-cost, high quality reports.

Buyer: After a buyer demonstrated high quality, I of course paid a little more for the investigation report. But it was worth it. In addition, I showed loyalty in staying with someone who was giving me what I wanted.

Buyer: I was willing to pay more for high peer review reports.

Reliance / 3 - year review

Strategy in early periods before peer review available:

Seller: Sell at high quality prices and provide low quality services.

Seller: Offer low investigations at prices a little above the high investigation costs.

Seller: Tried to charge a high price for low work.

Buyer: Stay with a consistently priced seller at medium to high price range. This helps to ensure that I am getting high investigation reports consistently.

Buyer: Bought the middle to high priced investigation in order to assure quality. I should have waited them out in order to drive prices down faster.

Buyer: I perceived the more expensive sellers to be offering higher value. This obviously did not work. Their reporting accuracy was obviously low.

Buyer: I took the most expensive one, hoping the investigation level was high. However, using percentages, I determined that I was not getting high investigations for high costs.

Strategy in later periods after peer review available:

- Seller: I used the peer review report services. I lowballed, offering about 30 cents under the cost of high quality to get a high rating out to the buyers. Then I went even lower with my offer, but changed to a low quality investigation.
- Seller: ... I tried to get my high report back, but was unable to, and unwilling to lowball enough under \$2.00. So, I was stuck to offering low quality service while continuing to lower my sales price and profit until the end.
- Seller: Since the prices being accepted were so low, I was forced to buy the low investigation and not have an analysis. I tried to make offers around 150 to still try and make a worth while profit.
- Seller: Low quality, low price services offered. Tried to offer high, but prices were too low.
- Seller: During any given period, I tried to give high service and charge a competitive price. Once I received a good report, Then I went back to charging higher prices for low investigations.
- Seller: Tried to make buyers think I was selling high, but really gave them low investigations.
- Buyer: I went with the lowest price.
- Buyer: I went with what seemed to be the most reliable seller (high investigations) with the lowest price.
- Buyer: Find the high peer review report and stick with him/her.
- Buyer: ... The report at the end really helped. Stayed away from low priced investigations. They seemed to imply low quality.
- Buyer: I based my choices on the sellers that had sold High services in the past based on the peer review.

How did you utilize the peer review report on the seller's investigation services?:

- Seller: I used it to gain confidence among buyers. Then they could be mislead.

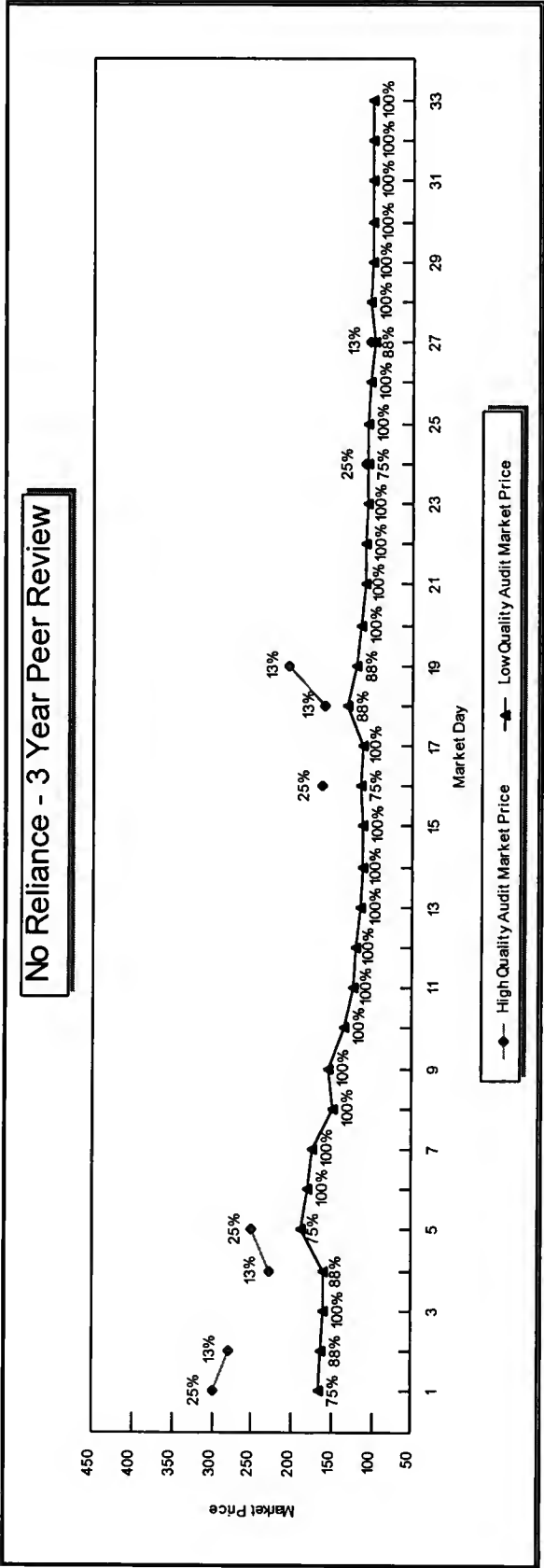
- Buyer: Paid only sellers who had consistently high ratings.
- Buyer: I tried to use is to evaluate the sellers patterns, but it did not help in the long run.
- Buyer: Completely helped, used knowledge that seller #3 consistently provided quality and now knew that the 100 premium was for higher quality.
- Buyer: I didn't follow the analysis. I didn't think it was helpful because is was past information (based on the prior three periods). I knew sellers would try to get away with things.

General Comments:

- Seller: Profits down because no one would buy from me in the end. (Note: This seller had shirked earlier and provided low investigation quality while indicating a high peer review report.)
- Buyer: Profits were not maximized because I did not know what type of investigation the sellers were providing.
- Buyer: What cost me profits was believing that higher prices meant higher quality.

APPENDIX D MARKET RESULTS

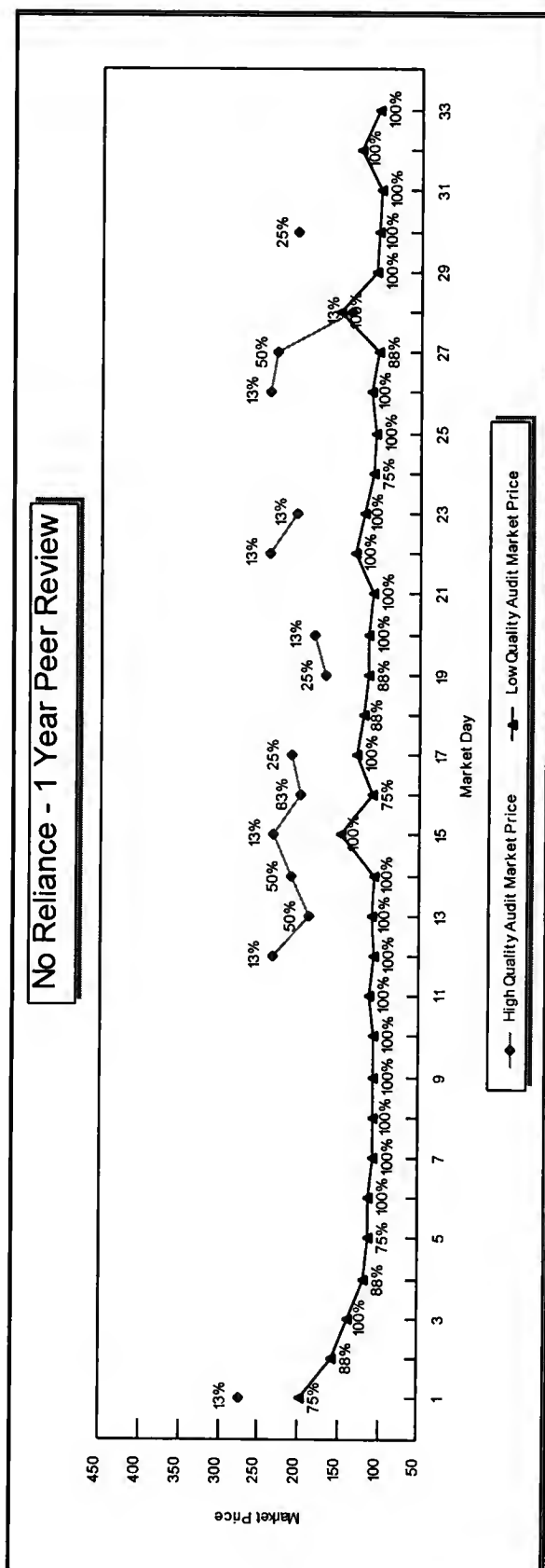
The following graphs display the average audit quality provided and the average market prices paid for each of the four market settings (A-D). Periods 1 - 15 represents market periods without peer review. Periods 16+ represent market periods with peer review.



Notes:

- The data points represent the percentage of high quality audits provided and the respective average price paid for each market day for markets in cell A₁ and A₂ of Figure 4-1.
- Peer review was not available for market days 1-15, or cell A₁. Peer review was available for market days 16-33, or cell A₂.

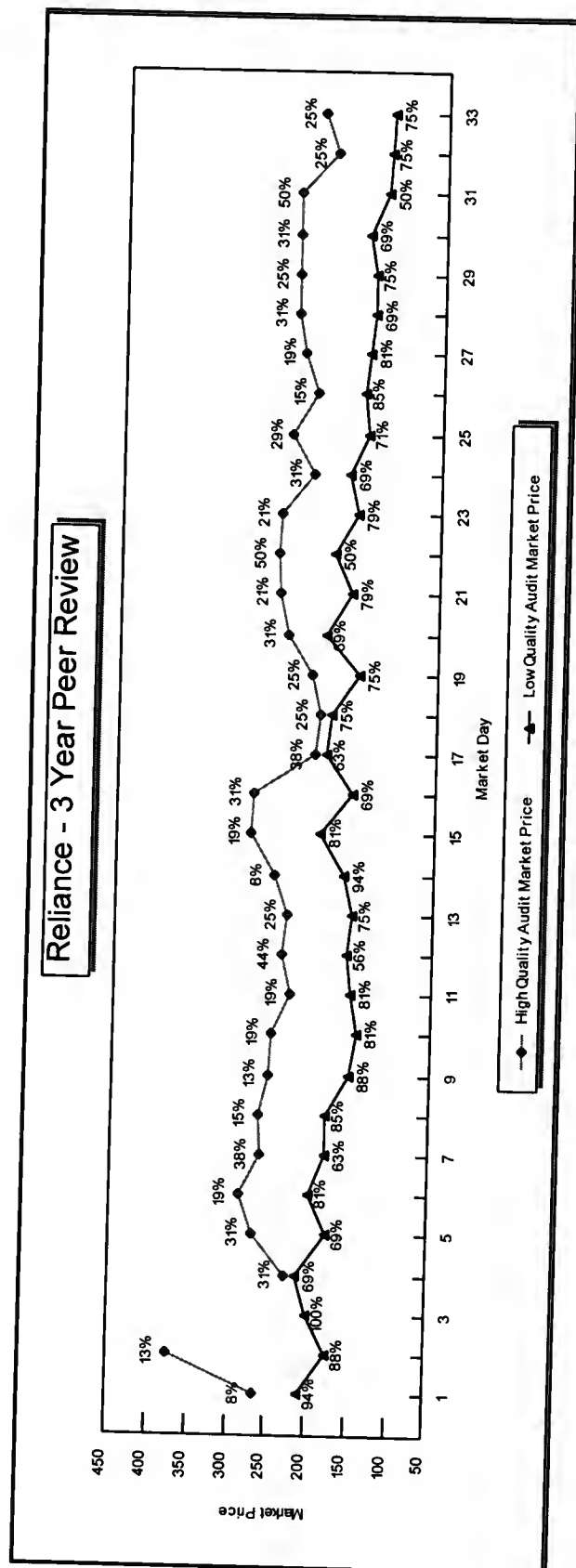
Figure D-1
Market Price/Quality Results



Notes:

- The data points represent the percentage of high quality audits provided and the respective average price paid for each market day for markets in cell B₁ and B₂ of Figure 4-1.
- Peer review was not available for market days 1-15, or cell B₁. Peer review was available for market days 16-33, or cell B₂.

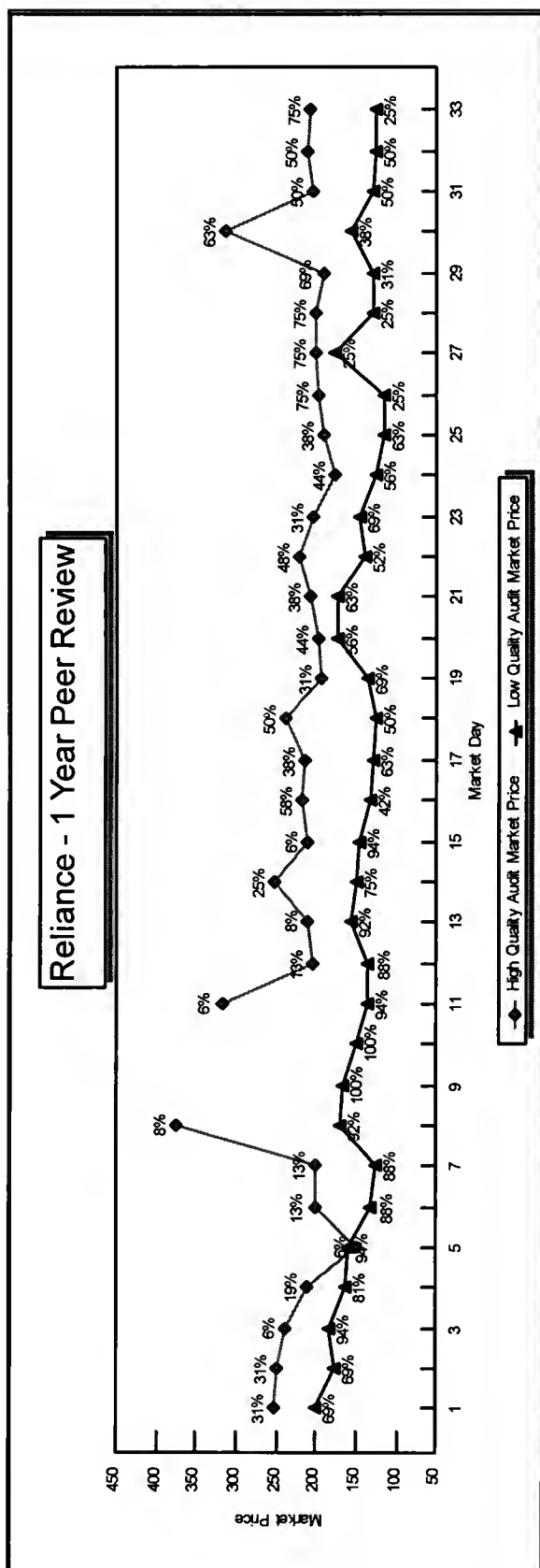
Figure D-2
Market Price/Quality Results



Notes:

- The data points represent the percentage of high quality audits provided and the respective average price paid for each market day for markets in cell C_1 and C_2 of Figure 4-1.
- Peer review was not available for market days 1-15, or cell C_1 . Peer review was available for market days 16-33, or cell C_2 .

Figure D-3
Market Price/Quality Results



Notes:

- The data points represent the percentage of high quality audits provided and the respective average price paid for each market day for markets in cell D_1 and D_2 of Figure 4-1.
- Peer review was not available for market days 1-15, or cell D_1 . Peer review was available for market days 16-33, or cell D_2 .

Figure D-2
Market Price/Quality Results

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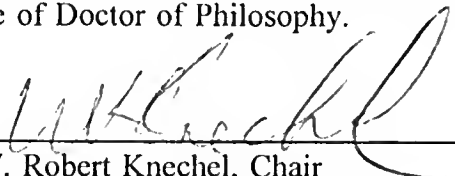
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BIOGRAPHICAL SKETCH

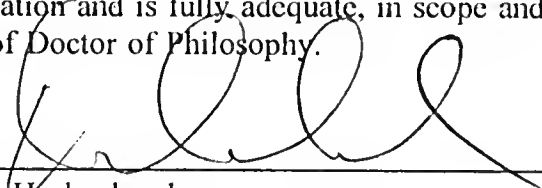
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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



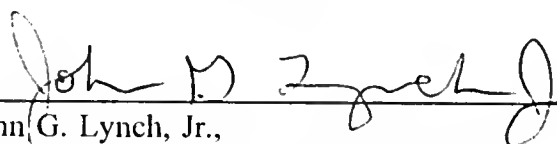
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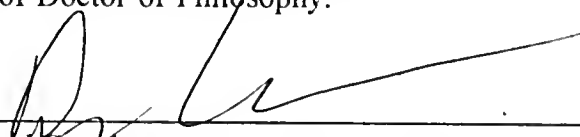
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August, 1995

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